

SCIENCE

VOL. 87

FRIDAY, MAY 20, 1938

No. 2264

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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal
Lancaster, Pa. Garrison, N. Y.
Annual Subscription, \$6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PRELIMINARY ANNOUNCEMENT OF THE OTTAWA MEETING

Edited by Dr. F. R. MOULTON

PERMANENT SECRETARY

THE meeting to be held in Ottawa from June 27 to July 2, inclusive, will be the hundred and second meeting of the association and the fifth Canadian meeting. The first Canadian meeting was held in Montreal in 1857, only nine years after the organization of the association; the second Canadian meeting was held in Montreal in 1882; the third, in Toronto in 1899; and the fourth, also in Toronto, in 1921. The approaching meeting will be the first one to be held in Ottawa, the capital of Canada.

OTTAWA

In 1613 Champlain and a few companions paused briefly on the promontory where Ottawa now stands to admire the broad sweep of the river against a background of the Laurentian Hills, which still remain tree-covered as they were three hundred years ago. For

two centuries the Ottawa River was the highway over which fur traders penetrated into the Upper Great Lakes and a considerable part of British America. The first white settler near the present site of Ottawa was Philemon Wright, of Massachusetts, who led a small company of pioneers to the region in 1800. In 1854 the name of the village which had grown up at the head of the Rideau Canal was changed from Bytown to Ottawa. In 1857 Ottawa was selected by Queen Victoria as the seat of the government of the provinces of Ontario and Quebec; in 1867 it became the capital of the Dominion of Canada.

At present the population of Ottawa is about 140,000. Being the capital city, it has magnificent public buildings superbly located on Parliament Hill. The Canadian Houses of Parliament are among the most graceful examples of Gothic architecture. A scenic

highway, noted for the beauty of its bordering trees and shrubbery, almost encircles the city, while broad streets lead through miles of attractive residence districts.

Ottawa is becoming more and more the headquarters for Canadian national organizations. For example, in it are the administrative offices of the Royal Society of Canada, the Canadian Historical Association, the Canadian Geographical Society, the Canadian Society of Technical Agriculturalists, the National Research Council of Canada and the Royal College of Physicians and Surgeons. There are also many other societies with headquarters in other cities, the total number of Canadian scientific and technical societies listed in the Third Edition of the Handbook published by the National Research Council being 143.

It appears to be difficult to realize that Ottawa is much nearer to the New England and the Middle Atlantic States than are the cities of the Middle West. As a matter of fact, it is only half as far from New York as Chicago is; last summer the association met in Denver, 1,100 miles west of Chicago. More than one quarter of the population of the United States is within 500 miles of Ottawa, not much more than a day's drive, while nearly half of it is within 1,000 miles. Railway connections with Ottawa from eastern and middle western cities are excellent.

HOTELS AND HEADQUARTERS

The headquarters of the meeting will be in the Chateau Laurier, a distinguished hotel with a capacity of more than 1,000 guests. (Single rooms, \$4 to \$5; double, \$6 to \$9). Other hotels and possibilities for obtaining rooms are as follows:

- Alexandra: Single, \$2.50; double, \$4.50.
- Roxborough: Single, \$3.00; double, \$4.50 to \$5.
- Windsor: Single, \$2.50; double, \$4 to \$6.
- Keewatni: Single, \$2 to \$2.50; double, \$3 to \$3.50.
- Ritz: Single, \$2; double, \$3.

The above-mentioned hotels have available rooms without bath at considerably lower rates.

REGISTRATION

Registration and all reservations for dinners and excursions will be in the Chateau Laurier.

RAILROAD FARES

The regular round-trip railway fares to Ottawa, including Pullman, from several principal cities in the eastern half of the United States are as follows: Boston, \$32.20; New York, \$34.20; Washington, \$50.20; Cleveland, \$51.30; Chicago, \$59.40.

OFFICIAL MEETINGS

The council of the association will meet on Monday, June 27, at 2:00 P.M., in the Chateau Laurier; thereafter daily at 9:00 A.M. until Thursday, June 30.

SOCIAL AFFAIRS AND DINNERS

On Tuesday afternoon there will be a garden party for all scientists, both from Canada and from the United States, at the Central Experimental Farm. A dinner for the members of the Section on Chemistry is scheduled for Tuesday evening. The Society of American Foresters will also have a dinner on Tuesday evening. On Wednesday the members of the Section on Psychology will hold a luncheon, and a joint symposium and dinner with the section on Education in the afternoon. On Wednesday evening the annual Hector Maiben lecture will be delivered by Dr. Robert C. Wallace, principal and vice-chancellor of Queen's University, Kingston, Ontario. Dr. Wallace's address will be on "The Changing Values of Science." The Canadian Committee is arranging for a drive around the city on Thursday afternoon. No regular scientific sessions are scheduled for Friday, July 1, Dominion Day, but there will be several excursions to places of interest, including one to the Ottawa Lowland, and another to Madoc, Ontario, by the geologists, and a four-day trip to the mining districts of Northern Ontario; one to Mer Bleue by the botanists and the zoologists; and one to Petawawa Forest Experimental Station by the Society of American Foresters on Friday. The Section on Anthropology plans an excursion to Toronto on Friday and Saturday, while the geologists will continue their excursion into northern Ontario and Quebec for several days.

GENERAL SESSIONS

Reference has already been made to the Hector Maiben lecture by Dr. Robert C. Wallace on Wednesday evenings. The four sessions of the second of the Science and Society conferences will be general programs of the association. The first session will be on Monday evening, the second on Tuesday evening, the third on Wednesday afternoon and the fourth on Thursday evening.

The Science and Society conferences are being organized by the Section on the Social and Economic Sciences, under the general direction of Dr. Harold G. Moulton. The first conference was held at Indianapolis last December on the subject "Fundamental Resources as Affected by Science." The subject of the Ottawa conference will be "Science and the Future." The first session will consist of the vice-presidential address of Dr. Stuart A. Rice on "World Standards of Living" and of a paper by Mr. F. E. Lathe, of Ottawa, on "World Natural Resources"; the second of an address by Dr. Arthur H. Compton, on "Physics of the Future" and another by Dr. Harold C. Urey on "Chemistry of the Future"; the third, of an address by Dr. William Crocker on "Botany of the Future" and another by Dr. Frank R. Lillie on "Zoo-

ogy of the Future"; and the fourth and final session will be by engineers representing leading industries.

SYMPOSIA

Integrations of broad fields of science in the form of symposia, which are usually participated in by two or more sections or societies, are becoming more and more distinguishing features of meetings of the association. Those known to be in preparation for the Ottawa meeting are the following:

The second conference in the Science and Society series of conferences, the subject of this conference being "Science and the Future." The program of this conference, which was outlined in the preceding section on General Sessions, will be held from Monday, June 27, to Thursday, June 30, inclusive.

Monday, June 27. The Section on Medical Sciences, the Genetics Society of America, the Phytopathological Society and veterinary and bacteriological groups, under the direction of Dr. E. C. Stakman, have organized and will present a symposium on "The Genetics of Pathogenic Organisms." The names of participants are not yet available. Section C and various industries, under the direction of Dr. S. J. Cook, have organized a symposium on "Heterogeneous Gas Reactions."

Tuesday, June 28. The Sections on Chemistry, the Medical Sciences and Agriculture are organizing a symposium on the "Nutrition Problem in North America." This program will include papers on both human and domestic animal nutrition. The Canadian division of the Section on Medical Sciences, under the direction of Dr. F. S. Burke, of Ottawa, has organized a symposium on "Bacillus Calmette-Guérin." Papers will be presented by Dr. A. Frappier, of Montreal, Dr. E. A. Watson, of Hull, Dr. Allan C. Rankin, of Alberta, Dr. Ferguson, of Saskatchewan, and Dr. J. A. Bandouin, of Montreal, and the discussion will be led by Dr. Wm. H. Park, of New York. The Sections on Chemistry and on the Zoological Sciences, under the chairmanship of Dr. Harold C. Urey, will present a symposium on "The Use of Isotopes in Biological Chemistry."

The American Phytopathological Society, the American Society of Plant Physiologists and the Genetics Society of America will join in a symposium on "Micro-elements and Deficiency Diseases."

Wednesday, June 29. The Entomological Society of America, the American Association of Economic Entomologists and the Entomological Society of Ontario will present a joint symposium on "The Relation of Insects to Forest Conservation." The Sections on Medical Sciences and on Chemistry, under the direction of Dr. S. J. Cook, have organized a symposium on "Medical Biochemistry." The papers in this symposium will include two from the laboratory of Dr.

F. G. Banting, two from the laboratory of Dr. C. H. Best and two from the laboratory of Dr. J. B. Collip. The Section on Zoological Sciences, under the leadership of Dr. A. G. Huntsman, will present a symposium on "Migratory Fish Resources." The American Society of Agronomy and the American and Canadian Committee on Pasture Improvement will present a symposium on "Comparison of the Nutritive Value of Pasture and Hay with Other Crops"; and the Canadian Society of Technical Agriculturists and the Canadian Society of Animal Production are organizing a symposium on "Progress of Swine Improvement in Canada." On Wednesday evening the sections on Psychology and on Education, under the direction of Dr. Edward A. Bott, will hold a joint dinner and discussion on "Scientific Study of the Education of the Dionne Quintuplets." The American Phytopathological Society, the Canadian Phytopathological Society, the American Society of Plant Physiologists and the Genetics Society of America will hold a joint meeting for discussing "Root Rots and Seed-borne Diseases," and a symposium on "Drought Resistance."

Thursday, June 30. The section on Zoological Sciences and the Ecological Society of America, together with the Section on Agriculture, the American Society of Foresters and the Canadian Society of Forest Engineers, will present a symposium on "Fire and its Biological Implications."

The Section on Botanical Sciences (G) will hold a symposium on "Physiographic Problems of Northeastern Canada," the participants being Drs. David Potter, Ernest C. Abbe, V. C. Wynne-Edwards, Jacques Rousseau and Frère Marie-Victorin.

SECTION AND SOCIETY PROGRAMS

Section on Physics (B). The section will hold sessions on Monday morning and afternoon and Tuesday morning. Thirteen papers will be presented, one of which will be on "Ultrasonics—Marine Applications," by Dr. R. W. Boyle, and another on "Noise Abatement Problems in Canada," by Dr. H. E. Reilley. Other papers will report on work with high and low frequency discharges and on β - and γ -rays.

Section on Chemistry (C). The Section on Chemistry starts its program on Monday with a symposium on "Heterogeneous Gas Reactions." It is expected that Dr. C. C. Coffin, of Dalhousie University, and Dr. J. W. N. Spinks, of the University of Saskatchewan, will appear on the program, as well as representatives of such industrial companies as Shawinigan Chemicals Limited, Canadian Industries Ltd. and the Consolidated Mining Company. On Monday afternoon Dr. Jerome Alexander will read a paper on "Some Chemical and Physical Aspects of Textile Fibers" and Mr. Pochon will discuss the refining of radium at Port Hope.

On Tuesday the program of the section is the symposium on the "Nutrition Problem in North America." Among the speakers who are expected to participate in this program are Drs. I. M. Rabinowich, E. W. McHenry, F. F. Tisdall, E. W. Crampton, C. J. Watson, N. D. Branion and R. D. Sinclair. In addition, it is hoped that Drs. W. D. McFarlane and A. R. G. Emslie will present papers on vitamin assays.

The program for Wednesday morning is the joint symposium with the Section on Medical Sciences on Medical Biochemistry, which will consist of at least six papers from the laboratories of Drs. F. G. Banting, C. A. Best and J. B. Collip.

Section on Astronomy (D). The program of this section has been organized by Dr. R. Meldrum Stewart, director of the Dominion Observatory of Ottawa. It will consist of twenty-four papers, including a survey of astronomical work in Canada for fifty years by Dr. W. E. Harper. Among other speakers on the program will be Drs. R. K. Young, Ralph E. DeLury, Harlan T. Stetson, W. E. W. Jackson, John L. O'Connor, C. S. Beals, G. H. Blanchet, Helen S. Sawyer, K. O. Wright, A. Vibert Douglas, Andrew McKellar, J. A. Pearce, R. M. Petrie and J. P. Henderson.

Section on Geology and Geography (E). This section will have meetings the entire week, and provisional arrangements have been made for field excursions until the evening of July 6 that will include visits to the Kirkland Lake, Noranda and Porcupine districts. In cooperation with the Association of American Geographers, programs dealing with the geography and physiography of southeastern Canada and the International Boundary and with the problems of the Northern Frontier have been arranged for Monday, Tuesday and Wednesday. The geologic sessions will be held jointly with the Geological Society of America and will begin on Tuesday. Three meetings have been tentatively scheduled, dealing with the economic, physical, Precambrian and Paleozoic geology of Canada and the Border States. Approximately thirty speakers will participate in the geographic and geologic programs. The section's field activities will include a local trip of interest to geographers, another under the leadership of Dr. Alice E. Wilson concerned with the Paleozoic geology of the Ottawa Lowland, a two-day trip (July 1 and 2) under the direction of Dr. M. E. Wilson to the Madoc district in Hastings Co., Ontario; and a four-day trip (July 2-6) to the mining districts of northern Ontario. Advance registration for the last trip will be necessary and will be handled either by Dr. Walter A. Bell (104 Victoria Museum, Ottawa) or by the section secretary, who will supply further details regarding the meetings and field excursions on request.

Section on Zoological Sciences (F) and Affiliated Societies. Section F and its affiliated societies will hold scientific sessions on Tuesday, Wednesday and

Thursday. On each of these three days the section participates in symposia with its affiliated societies and with another section. On Tuesday morning it joins with the Section on Chemistry in a symposium on "The Use of Isotopes in Biological Chemistry." On Wednesday it takes the lead under the chairmanship of Dr. A. G. Huntsman in a symposium on "Migratory Fish Resources." On Thursday it cooperates with the Section on Agriculture (O), the Ecological Society of America, the Society of American Foresters and the Canadian Society of Forest Engineers in a symposium on "Fire and its Biological Implications."

The Entomological Society of America, the American Association of Economic Entomologists and the Entomological Society of Ontario will hold meetings from Monday to Saturday, including a symposium (day not announced) on "The Relation of Insects to Forest Conservation" and several general sessions with a total of more than thirty papers.

Section on Botanical Sciences (G) and Affiliated Societies. This section will hold a symposium on "Physiographic Problems of Northeastern Canada." The participants are David Potter, Ernest C. Abbe, V. C. Wynne-Edwards, Jacques Rousseau and Frère Marie-Victorin.

The Ecological Society of America will have scientific sessions or field trips throughout the week. The general chairman for the Ottawa meeting of the society is Dr. H. C. Hanson, its president, and its secretary is Dr. Orlando Park. The local committee for the Ottawa meeting is Dr. A. G. Huntsman, chairman, Dr. H. G. Crawford, Dr. J. R. Dymond, Dr. Arthur Gibson and Mr. H. L. Trueman. The program of the society on Tuesday will consist of joint sessions with the Society of American Foresters and the Canadian Society of Forest Engineers, under the chairmanship of Dr. C. F. Korstian. On Wednesday the society holds a joint session with the Section on Zoology (F) on animal ecology under the chairmanship of Professor A. F. Coventry. On Thursday the society participates with the Section on Zoology (F), the Society of American Foresters and the Canadian Society of Forest Engineers in the symposium on "Fire and Its Biological Implications," under the chairmanship of Dr. Paul B. Sears. On Friday and Saturday the society will sponsor field trips under the direction of Dr. J. R. Symond. The field trip on Friday will be to Meleau, an extensive phagnum bog ten miles east of Ottawa. The other field trip will be an overnight excursion, beginning on Friday, to the Petawawa Forest Experiment Station. This trip is under Dr. Roland D. Craig. The local committee on arrangements, Dr. J. R. Dymond, secretary, Royal Ontario Museum of Zoology, Toronto, desires to hear well in advance of the Ottawa meeting from all ecologists who

may wish to visit the Precambrian region north of Ottawa or other ecological features of the region.

The American Society of Plant Physiologists will meet on Tuesday with the American Phytopathological Society and the Genetics Society of America for a symposium on "Micro-elements and Deficiency Diseases." On Wednesday the society has planned a symposium on "Root Rots and Seed-borne Diseases" and another one jointly with the Genetics Society of America on "Drought Resistance." Thursday morning will be devoted to a program of general papers and in the afternoon a visit will be made to Central Experimental Farm.

The American Phytopathological Society will participate on Monday in the symposium on "The Genetics of Pathogenic Organisms."

The Society of American Foresters and the Canadian Society of Forest Engineers will hold joint sessions from Monday to Saturday, inclusive. The opening meeting will be held on Monday afternoon, under the chairmanship of Professor J. Miles Gibson, and the societies will make a tour of the city in the evening. There will be two sessions on Tuesday for the presentation of general papers, followed by a dinner in the evening. Dr. C. F. Korstian will preside at the forenoon session and Professor J. Miles Gibson in the afternoon. On Wednesday there will also be two general sessions with the presiding officers interchanged, and in the evening there will be a visit to Parliament Buildings. On Thursday the societies will participate in the symposium on "Fire and its Biological Implications," following which they will visit the Canadian International Paper Company mill. On Friday the societies will drive to the Petawawa Forest Experiment Station, after which they will dine at headquarters. Members will remain at headquarters overnight and continue on Saturday with discussions of silviculture and observation of fire pump tests.

The Genetics Society of America will hold sessions from Monday to Thursday, inclusive. On Monday the society will participate in the symposium on "The Genetics of Pathogenic Organisms." On Tuesday morning it will have a round-table conference on "The Application of Cytogenetics to Plant Improvement," and a symposium held jointly with the American Phytopathological Society and the American Society of Plant Physiologists on "Micro-elements and Deficiency Diseases," and will attend the garden party at the Experimental Farm in the afternoon. On Wednesday it will hold a symposium jointly with the American Society of Plant Physiologists on "Drought Resistance." On Thursday it will hold a session for cytogenetic demonstration papers and will visit various divisions of the Experimental Farm.

Section on Anthropology (H). The section will have sessions in Ottawa from Monday to Thursday,

inclusive, and will go to Toronto on Friday for two days as guests of the Royal Ontario Museum of Archeology, in Toronto, which contains among its splendid exhibits an unrivalled Chinese collection. Dr. D. Jenness, chairman of the section, will preside at the session on Monday morning which will be devoted mostly to prehistoric Canadian Indians, but will include papers on the early history of Chinese and Egyptian culture. On Tuesday morning the section will hold a session for the reading of papers on a variety of anthropological subjects, and in the afternoon the section will attend the garden party at the Experimental Farm. The Thursday morning program will consist of papers on American Indians, and in the afternoon the section will attend the session of the "Science and Society" symposium. No formal programs are scheduled for Thursday.

Section on Psychology (I). Under the direction of Dr. Edward A. Bott, the section will have sessions for the presentation of general papers on both Tuesday and Wednesday, and on Wednesday evening it will join the Section on Education at a dinner, following which there will be a symposium on "Scientific Study of the Education of the Dionne Quintuplets."

Section on Social and Economic Sciences (K) and Affiliated Society. The program of the section consists of four sessions which constitute the second of the conferences on "Science and Society," the subject of the Ottawa conference being "Science and the Future." The first session, on Monday evening, will consist of two addresses, one on "World Standards of Living" by Stuart A. Rice, chairman of the section, and the other by Mr. F. E. Lathe, chairman of the Program Committee of the Canadian Committee for the Ottawa Meeting and director of the Division of Research Information in the Canadian National Research Council on the subject "World Natural Resources." The second session, which will be held on Tuesday evening, will be on the subject, "Physical Sciences and the Future." One of the two addresses of this session will be by Dr. Arthur H. Compton, of the University of Chicago, and the other by Dr. Harold C. Urey, of Columbia University. Both Dr. Compton and Dr. Urey have been recipients of Nobel prizes for their researches. The third session, on Wednesday afternoon, will be on "Biological Sciences and the Future." Dr. William Crocker, director of Boyce Thompson Institute for Plant Research, Inc., will deliver an address on the subject from the point of view of botany and Dr. Frank R. Lillie, President of the National Academy of Sciences, another from the point of view of zoology. The final session will be on "Future Advances of Science" from the point of view of engineering and business administration.

The American Statistical Association will hold two sessions on Tuesday, the general topic for the one in

the morning being "The Influence of the Course of Business in the United States on the Course of Business in Canada during the Past Decade," and in the afternoon on "Government Spending and Business Recovery." On the morning program, Dr. D. C. MacGregor, University of Toronto, and Mr. Walter Gardner, of the Board of Governors of the Federal Reserve System, will be the principal speakers. On Wednesday morning there will be a session on comparison of the structure and trends of retail and wholesale trade in Canada and the United States. The principal speakers will be Mr. H. Marshall, of the Dominion Bureau of Statistics, and Mr. Vergil Reed, of the U. S. Census Bureau. In addition, Mr. Willard Thorp of Dun and Bradstreet will speak on the effects of credit and inventories on the flow of goods.

On the afternoon of the 29th the American Statistical Association will join with the Canadian Agricultural Economics Society and the Canadian Society of Technical Agriculturalists in a program on weather and crop yields. The speakers will be C. F. Sarle, of the U. S. Bureau of Agricultural Economics, George Montgomery, of Kansas State College, and C. F. Wilson, of the Dominion Bureau of Statistics.

Section on Historical and Philological Sciences (L). The program of the section will consist of a symposium on "The Progress of Science in Canada" and of a paper on "Why the Social Sciences Lag Behind the Biological and Physical Sciences," by Dr. Joseph Mayer, secretary of the section. The symposium will be participated in by Dr. W. E. Harper (Astronomy), Dominion Astrophysical Observatory, Victoria; Dr. S. Beatty (Mathematics), University of Toronto; Dr. J. R. Dymond (Zoology), University of Toronto; Dean Frank D. Adams (Geology), McGill University; Dr. Marie-Victorin (Botany) University of Montreal; Dr. W. Lash Miller (Chemistry), University of Toronto; Dr. A. Norman Shaw (Physics), McGill University; Dr. L. E. Parisean (Medical Research during French Regime), Montreal; Dr. John Dearness (History of Improvement of English Orthography in Canada), University of Toronto.

Section on Engineering (M) and Affiliated Society. The section will hold one session for reading of four papers as follows: "The Collapse of the Falls-View Bridge at Niagara Falls," by P. L. Pratley; "Mining, Concentration and Transportation Operations of Eldorado Gold Mines Limited," by M. Pochon; "Some Instrumental Aids to Mapping from Air Photographs," by R. H. Field. The fourth paper will be on an electrical engineering subject, title of which has not yet been announced.

The Institute of the Aeronautical Sciences Inc., will present a program on Monday, Tuesday and Wednesday. Among the papers which will be presented are

"Flying Boats," by I. I. Sikorsky, president of Sikorsky Aircraft; "The Radiometeorograph," by Dr. W. R. Gregg, chief of U. S. Weather Bureau; "Pressure Waves Accompanying Detonation in Internal Combustion Engines," by Professor C. S. Draper, The Daniel Guggenheim Aeronautical Laboratory; "Aircraft Fuels," S. D. Hiron, Ethyl Gasoline Corporation; "Photoelectric Stress Methods," by Professor T. R. Loudon, University of Toronto; "Snow Performance of Aircraft Skis," by G. J. Klein, National Research Council of Canada; "The Cathode Ray Compass," by Dr. J. T. Henderson, National Research Council of Canada; "Meteorology," by Dr. J. Patterson, Meteorological Service, Langley Field.

Section on Medical Sciences (N) and Sub-section on Pharmacy. The section will conduct symposia on Tuesday and Wednesday. The symposium on Tuesday will be on "Bacillus Calmette-Guérin," consisting of five papers. The papers are: "B.C.G. Vaccine, eleven Years' Experimental Work on its Innocuity and Efficacy," by Dr. A. Trappier, University of Montreal; "B.C.G. Vaccination of Cattle and Resistance to Tuberculosis," by Dr. E. A. Watson, chief pathologist of Department of Agriculture, Hull, Quebec; paper (title not announced) by Dr. Allan C. Rankin, University of Alberta; another by Dr. Ferguson, of Saskatchewan; "Twelve Years' Experience with B.C.G. Vaccine at the University of Montreal"; and discussion led by Dr. Wm. H. Park, of New York.

The session on Wednesday is a joint symposium with the Section on Chemistry (C). The papers are: "Hormones and Immunity," by Drs. W. R. Franks and F. G. Banting, the University of Toronto and the Banting Research Foundation; "Bio-electric and other Physiological Responses of Insulin and Nutrazol," by Drs. J. E. Goodwin, G. E. Hall, B. Leibel and D. P. C. Lloyd, the University of Toronto; "The Prolongation of the Action of Insulin," by Dr. Albert Fisher, the University of Toronto; "The Purification of Heparan," by Dr. Arthur Charles, the University of Toronto; "The Ketogenic and Anti-Insulin Properties of Anterior Lobe Extracts," by Drs. A. H. Neufeld and J. B. Collip, McGill University; and "Studies on the Specific Metabolic Stimulant of Pituitary Extracts," by Drs. O. K. O'Donovan, O. F. Denstedt and J. B. Collip, McGill University.

The Sub-section on Pharmacy will present a program on Monday consisting of at least seven papers as follows: "Some Recent Developments Concerning Vitamin E" by Drs. E. M. Watson and C. S. McArthur; "On the Excretion of Oestrogens and Gonadotropic Hormone in the Urine of the Pregnant Sow" by Drs. E. Loginski, G. W. Holden and E. N. Maenlum; "Ultra-violet Fluorescence as an Aid in the Identification of Vegetable Drugs and their Extracts,"

by Dr. Curt P. Wimmer; "Some Observations on the Cardiac Tonic Drugs Apocynum and Convallaria," by Dr. Heber W. Youngken; "Some Factors that Influence Endocrine Reactions," by Drs. E. L. Schwabe and E. E. Emery; "The Assay of Thyrotropic Hormone," by Drs. A. S. Cook and C. M. Hayes; and "Electro-osmosis, its Applications, and the Latest Discoveries Concerning the Penetration of Drugs in Living Tissues and in Heart Substances," by Dr. Louis C. Barail.

Section on Agriculture (O) and Affiliated Societies. The section as such will present no programs, but its affiliated societies, the Society of American Foresters and the Canadian Society of Forestry Engineers, will hold joint meetings on Monday, Tuesday, Wednesday and Thursday. The program on Monday afternoon, under the chairmanship of Professor J. Miles Gibson, will discuss "Administration of Crown Lands in Canada." The general subject of discussion on Tuesday morning, under the chairmanship of Dr. C. F. Korstian, is "Silviculture in Pulpwood Operations." On Wednesday morning these societies will hold a joint session with Forest Entomologists and Forest Pathologists, under the chairmanship of Dr. J. M. Swaine. On Thursday morning the societies join the Ecological Society of America in a symposium on "Fire and its Biological Implications." On Friday and Saturday the societies will make an excursion to Petawawa Forest Experiment Station (125 miles).

The Canadian Society of Technical Agriculturists will hold business sessions on Monday and will present scientific programs on Tuesday, Wednesday and Thursday. On Tuesday morning the Soils Group, under the chairmanship of Dr. J. Mitchell, will present a program of six papers. On Tuesday afternoon the Horticultural Group, under the chairmanship of Dr. C. F. Patterson, will present a program of nine papers. On Wednesday morning the Horticultural Group, under the chairmanship of Dr. M. B. Davis, will present a program of six papers. And also on Wednesday morning the Soils Group, under the chairmanship of Dr. L. E. Wright, will present a program of seven papers; and on Thursday morning a program of two papers and a round-table discussion on "Laboratory Methods and Technique in Soil Research with Special

Reference to Standard Determinations in Connection with Soil Survey Samples."

The Agricultural Economics Group of the Canadian Society of Technical Agriculturists is planning a program in connection with the Section on Social and Economic Sciences (K).

The Animal Industry Group on Tuesday afternoon will present a program, under the chairmanship of Dr. A. R. Ness, of eight papers.

The Plant Industry Group is planning a program in cooperation with the Canadian Phytopathological Society and the Section on Botanical Sciences (G).

The American Society of Agronomy is holding joint meetings with the American and Canadian Committee on Pasture Improvement and participates in a round-table conference on "Comparison of the Nutritive Value of Pasture and Hay with Other Crops."

Section on Education (Q). The section will hold general sessions on Tuesday and Wednesday. The first to be held on Tuesday morning will consist largely of papers on organizational and administrative problems in Canadian education. The second on Tuesday afternoon will be a joint session with the Section on Psychology (I) devoted largely to child study and the psychological aspects of education.

There will be two round-table discussions, the first, to be held on Wednesday morning under the chairmanship of Dr. V. K. Greer, will be on "Problems of the Curriculum of Elementary Schools." The second, to be held on Wednesday afternoon under the chairmanship of Major H. B. King, will be on "Problems of the Curriculum of Secondary Schools." At noon on Tuesday there will be a luncheon which will be followed by a discussion of and preliminary plans for the establishment of a Dominion Bureau of Research. This discussion will be under the chairmanship of Dr. Henry F. Munro, president of the Canadian Educational Association and superintendent of education for Nova Scotia. On Wednesday evening there will be a joint dinner with the Section on Psychology, which will be followed by reports on "The Scientific Study of the Education of the Dionne Quintuplets." This discussion is under the chairmanship of Dr. Edward A. Bott, of the University of Toronto.

OBITUARY

MAURICE CROWTHER HALL

By the death of Dr. Maurice Crowther Hall on May 1, 1938, the National Institute of Health of the U. S. Public Health Service lost a competent research scientist and administrator; parasitologists the world over lost one of their best-known and highly regarded colleagues; and the veterinary profession of the United States lost one of its most distinguished members. Dr.

Hall's death followed an operation for gastric ulcers from which he had suffered for about twenty years. That he was able to carry on his administrative and scientific work despite this serious handicap is evidence of an indomitable will and a resolute determination to pursue his work in the face of a devitalizing disease to which he finally succumbed.

Dr. Hall was born in Golden, Colorado, on July 15,

1881. He was of English stock and the son of a man to whom he always referred affectionately as a "pioneer." From his father he inherited the pioneering instinct which found expression in much of his scientific work, and from his early environment in the West he imbibed a freshness of spirit and a lasting vigor which stayed with him even in his final illness.

Following his graduation from Colorado College in 1905 with a B.S. degree, he attended the University of Nebraska for a year as a graduate student of parasitology under Professor Henry B. Ward and received the A.M. degree in 1906. After a year's teaching in high school in his native State, Dr. Hall went to Washington, D. C., in 1907 to join the staff of the Zoological Division of the Bureau of Animal Industry of the U. S. Department of Agriculture. With something that was greater than mere enthusiasm of youth, coupled with a tremendous capacity for hard work and sustained interest and effort, Dr. Hall became deeply engrossed in the then slightly explored field of veterinary parasitology. While his interests in that science were at first those of a zoologist, and naturally led him to study the morphology and classification of helminths, he quickly realized the importance of developing methods for the control of parasites that were highly injurious to the livestock industry in certain parts of the country. Control by treatment with drugs and chemicals appealed to him at the start, and one of his earliest contributions deals with anthelmintics. Though he carried a heavy program of research in the laboratory and in the field over a period of nine years, he found time to supplement his formal training; in 1915 he received the Ph.D. degree and the following year he received the D.V.M. degree from the George Washington University. His doctorate thesis in zoology, on nematodes parasitic in rodents, was a valuable contribution to nematology and an early attempt to define the higher groups of these economically important parasites.

Dr. Hall's interest in parasitology soon swung to the therapeutic phase almost altogether, and he made research in anthelmintics his major interest following the completion of his Ph.D. thesis. Upon resigning his position in the Bureau of Animal Industry in 1916, he joined the staff of Parke, Davis and Company as research parasitologist, and during a period of about two years he turned out numerous papers on the therapeutics of verminous diseases of domestic animals. His work at the Parke, Davis and Company laboratories was interrupted by the world war; Dr. Hall was commissioned a second lieutenant and later a first lieutenant in the newly organized veterinary corps of the U. S. Army. Shortly after the war he returned to the Bureau of Animal Industry in 1919 as senior zoologist and assistant chief of the Zoological Division, and resumed his researches on anthelmintics. This led to

his most important work, namely, the discovery in 1921 that carbon tetrachloride, a chemical not in use at that time as a drug, was an effective treatment for the removal of hookworms from dogs. In the same year he proposed in a published article the cautious use of this newly discovered remedy in human medicine for the treatment of hookworm disease. Since 1921 several million people in the tropical and subtropical belts of the globe have been treated with carbon tetrachloride, and for many years this was the common drug used for this purpose in human medicine. In South America it was found that following treatment with carbon tetrachloride the efficiency of laborers in the mines increased by about 30 per cent. The success attained with carbon tetrachloride as an anthelmintic in human and veterinary medicine did not altogether still Dr. Hall's ambition to find another remedy with a higher safety factor. In 1925 he announced that tetrachlorethylene was just as effective as carbon tetrachloride and apparently much safer, basing his conclusions on extensive experiments with dogs. The new remedy gradually supplanted carbon tetrachloride, and tetrachlorethylene is now the standard treatment for hookworm disease, human and canine. So far as is known, no fatalities have been recorded following the administration of tetrachlorethylene. Aside from this outstanding work in the field of therapeutics, Dr. Hall standardized many of the anthelmintics in common use in veterinary medicine and added several new ones to the list. He was generally regarded as the outstanding authority in the world in anthelmintic medication.

In 1936 Dr. Hall resigned his position as chief of the Zoological Division of the Bureau of Animal Industry to which he was promoted in 1925, following the death of his predecessor, Dr. B. H. Ransom, to accept the position as chief of the Division of Zoology of the National Institute of Health of the U. S. Public Health Service. The new assignment naturally led Dr. Hall into the field of human parasitology, and he devoted himself largely to the study of trichinosis, calling special attention to the wide-spread occurrence of this disease in the United States.

Dr. Hall received recognition for his scientific work in this country and abroad. He served on the editorial boards of the *Journal of Parasitology* and *Biological Abstracts*, was a member of the National Research Council, a delegate to the Pan-American Scientific Congress (1915-16), president of the Permanent International Committee on Parasitology, a foreign member of the Royal Academy of Agriculture of Torino, Italy, and held offices at various times in scientific societies. In 1925 his alma mater conferred on him the honorary Sc.D. degree.

Dr. Hall had an attractive personality, coupled with a very pleasing appearance. He was a delightful conversationalist and an impressive public speaker.

Totally devoid of what is conventionally known as an oratorical flair, he impressed his audiences by his sincerity, knowledge of his subject and fluency of expression. His ability as a writer even surpassed his talent for public speaking, his scientific and popular papers being written with clearness, precision and in an attractive literary style. Dr. Hall had an unusual flair for literary expression, and he frequently indulged in writing articles on the philosophical and social aspects of parasitism, government, civil service, animal experimentation and other topics; most of his literary articles on these subjects were published in the *Scientific Monthly*. His high sense of social justice, his freedom from the common prejudices of mankind and his hatred of sham and hypocrisy were frequently brought out in his popular articles and in public addresses.

In his personal relationships with the scientific staff under him he was uniformly courteous, tactful and

tolerant. He was always ready and willing to give advice to young and inexperienced workers and lend a helping hand not only to his immediate staff but to the many visitors who came to the Bureau of Animal Industry to consult its index catalogues and to work in its laboratories. Among parasitologists and veterinarians Dr. Hall was held in high esteem, as evidenced by his election to the presidency of the American Society of Parasitologists and the presidency of the American Veterinary Medical Association.

Dr. Hall's life was a conspicuous example of wholehearted devotion to the public service which he frequently publicized and defended with his facile pen, a passionate interest in the science of parasitology and a complete dedication of his talents and physical energy to the welfare of his country and humanity.

BENJAMIN SCHWARTZ

U. S. BUREAU OF ANIMAL INDUSTRY

SCIENTIFIC EVENTS

SCIENCE AT THE EMPIRE EXHIBITION, GLASGOW

Nature gives the following account of the Empire Exhibition, which opens next month at Glasgow. It will be the largest and most representative exhibition, with the exception of Wembley that has been held in the history of the British Commonwealth. It will present an impressive representation of the industrial and manufacturing capacity of the British Empire and will show the progress of civilization within the Empire in many of its different aspects. Both in the industrial exhibits and in those for which the government is directly responsible, research will occupy a prominent position. The theme of research will be symbolized in the huge sculptured feature, more than 40 feet in height, which occupies the lofty entrance court of the United Kingdom Pavilion. Above the "original elements," earth, water and air, represented by a golden sphere about which water continuously plays, a figure typifying man's questing spirit is seen to ride on a great silver wave. This figure bears the symbols of energy which science has placed within the grasp of man. The first of the four exhibition halls, each covering an area of 5,000 square feet, which form the United Kingdom Pavilion, is being devoted to a "Fitter Britain" exhibit organized by the Ministry of Health in cooperation with the Board of Education, the Scottish Department of Health and the National Fitness Council. This exhibit will illustrate how the application of scientific knowledge is leading to a healthier nation.

Exhibits in the other three halls in the pavilion have been organized by the Department of Scientific and

Industrial Research. The aim of these halls is to demonstrate the part played by scientific knowledge and research in the industrial life of the nation. The three great national industries, coal, iron and steel and shipbuilding, have been selected to illustrate this theme, and one hall is devoted to each of these subjects. In planning the exhibits the department has had the fullest cooperation from industry. Important industrial organizations, such as the Mining Association of Great Britain, the Gas Federation, the Iron and Steel Federation and the Shipbuilding Conference, besides scores of leading firms, have freely given their assistance. Elsewhere in the exhibition the Ministry of Agriculture and Fisheries and the Forestry Commission, in cooperation with the Scottish Department of Agriculture and the Scottish Fishery Board, are showing exhibits illustrating some of the benefits which modern research has brought to agriculture, fishing and forestry. In the agricultural section, dairying, animal nutrition, fruit growing, land crop improvement and animal diseases are dealt with. One section will deal with the gas storage of fruit developed by the Food Investigation Board, and another shows the application of chemistry to the problem of keeping soil fertile. In the forestry section the Forest Products Research Laboratory is cooperating with the Forestry Commission in staging an exhibit illustrating the work of the laboratory as applied to home-grown timber. Another application of industrial research will be shown in an exhibit in the Palace of Engineering arranged by the Home Office, which will demonstrate modern methods of promoting the safety, health and welfare of industrial workers.

THE MARINE BIOLOGICAL LABORATORY OF DUKE UNIVERSITY

DURING the summer of 1938 Duke University plans to offer courses in biology and opportunity for research at Piver's Island, Beaufort, N. C. Construction has begun on a laboratory, lecture and recreation hall, dormitories, dining-hall, pier, boat house, pump house and other structures. In 1902 the United States Bureau of Fisheries established a biological station on Piver's Island because "Beaufort, N. C., was found to be a place especially well suited for the study of marine fauna and flora." Since then the biota has become well known through work to which many famous biologists have contributed (Gill, Stimpson, Cones, Yarrow, Brooks, Wilson, Mast, Hoyt, Lewis, Hay, etc.). Piver's Island is only 150 yards from the mainland and the historic town of Beaufort. In 1936 a bridge was built across to U. S. Highway 70, so the island is readily accessible by automobile. The Fisheries Station is situated on the north end of the island; the Duke University Marine Laboratory is being built on 11.5 acres south of that. There is easy access by boat or automobile to Bogue and Pamlico sounds, neighboring rivers and creeks, canals, mud flats, sandy shores, banks, dunes, marshes, peat bogs, cypress swamps, bird islands and other habitats of great biological interest. Among typical southern plants which occur long leaf pine, yocon, several insectivorous plants and palmetto may be mentioned. A great variety of algae, both fresh-water and marine, are available. Among animals there are king crabs, crabs, ctenophores, sponges, snails, clams, squids, hydroids, many fishes, gannets, cormorants, herons, sea turtles, porpoises, etc. A daily train from Goldsboro and busses furnish transportation to Beaufort.

The station is to be equipped with running salt- and fresh-water and electricity. There are to be tanks and aquaria for keeping plants and animals under observation. Books and other literature will be brought from the Duke University Library. Double rooms will be available in the dormitories. Microscopes and equipment and ordinary reagents will be furnished, but students are expected to have dissecting instruments.

Registration should be arranged through the Summer School Office, Duke University, Durham, N. C. Courses are intended for students who have had at least two years of work and may be counted toward work for A.M. or Ph.D. degrees. A student may obtain a maximum of twelve-semester hours credit during the entire summer, or six-semester hours for six weeks.

Dr. A. S. Pearse has been appointed director. Dr. H. L. Blomquist will be in charge of botany and Drs. I. E. Gray and A. S. Pearse will be in charge of zoology.

There are ample opportunities for recreation—

swimming, fishing, boating, etc. One or two illustrated lectures on general biological subjects or travel will be given at the station each week. There are theaters in Beaufort and Morehead City.

THE COMMITTEE ON THE IMPROVEMENT OF SCIENCE IN GENERAL EDUCATION

ON December 30, 1937, the Executive Committee and Council of the American Association for the Advancement of Science passed the following resolution: "The council voted to direct its standing Committee on the Place of Science in Education to represent the association in the organization of plans for the evaluation and improvement of the teaching of science in colleges." Tentatively, the new group is designated as the Committee on Improvement of Science in General Education.

The proposed functions of the committee are:

General: To initiate, encourage, guide and support studies designed to explore, evaluate and improve the teaching of the sciences as a part of general education.

Specific: 1. To clarify and define the problems involved in teaching the sciences as a part of the program of general education.

2. To develop a more scientific attack upon problems of science teaching; that is, to promote experimentation; to collect evidence, to encourage the use of procedures justified on the basis of organized and evaluated evidence in contrast to opinions, untested assumptions and uncritical acceptance of traditional practices.

3. To disseminate information about the committee's work, and to secure constructive criticism by means of discussion groups in college and university centers, by participation in programs and by such other means as may be found effective.

4. To obtain and to use financial support for such work in the sciences as gives promise of being effective in improving the teaching of science in general education.

5. To serve as a clearing house for coordinating the activities of the several agencies now working on parts of the whole problem and new agencies which may be initiated for the improvement of science teaching.

6. To act in an advisory capacity on any studies approved by it and supported through it; to require and coordinate reports of such studies, and to provide for publication of the findings.

The Committee on the Place of Science in Education met with the initial members of the new committee in Columbus, Ohio, on April 30 and May 1. Discussions were held regarding the nature and purposes of the proposed work, and about possible and desirable procedures. The initial plans will soon be presented in a separate statement by the chairman of the new committee. Response has not yet been received from all who were invited to become members of the committee. The following is the list of those who have accepted, and the officers elected by them:

Lloyd W. Taylor, *chairman*, Oberlin College.
Ralph W. Tyler, *vice-chairman*, the Ohio State University.

A. C. Kinsey, *secretary*, Indiana University.
H. J. Arnold, Columbia University.
Carey Croneis, University of Chicago.
Bert Cunningham, Duke University.
C. C. Furnas, Yale University.
Dr. Neil E. Gordon, Central College, Fayette, Mo.
Joel S. Georges, Wright Jr. College, Chicago.
M. F. Guyer, University of Wisconsin.
E. R. Hedrick, University of California.
C. J. Lapp, University of Iowa.
Kirtley Mather, Harvard University.
Homer C. Sampson, the Ohio State University.
Paul B. Sears, the University of Oklahoma.

Report submitted by the Committee on Place of Science in Education.

OTIS W. CALDWELL, *Chairman*

AWARDS OF THE ELIZABETH THOMPSON SCIENCE FUND

At a meeting of the trustees of the Elizabeth Thompson Science Fund held on April 20, the following grants were awarded:

\$200 to Dr. Kurt G. Stern, Yale University, for the continuation of his work on the constitution of catalase and the mechanism of enzyme action; \$257 to Dr. Ludvig G. Browman, the Montana State University, for studies of oestrous and activity rhythms of rats under various light conditions; \$59.41 to Dr. C. R. Johnson, the University of Texas, for research on atomic weights of various elements, particularly cadmium; \$200 to Dr. J. O. Pinkston, the American University of Beirut, for a study of the pharmacological relationship between certain sympathomimetic drugs and chemical mediators of the sympathetic nervous system; \$325 to Leigh Chadwick and Dr. H. E. Edgerton, Harvard University and the Massachusetts Institute of Technology, to obtain high-speed motion pictures of insects in flight; \$150 to Dr. L. T. Evans, the Montana State University, for work on the relation of the male sex hormone in mating and territory behavior and of anti-hormones in turtles and lizards; \$250 to Dr. Edward Girden, for a continuation of his study of auditory phenomena.

The trustees of the fund are as follows: G. P. Baxter, president; Jeffries Wyman, Jr., secretary; Charles P. Curtis, treasurer; G. B. Wislocki, J. C. Slater, A. C. Redfield, trustees. The next meeting will be held in April, 1939, and applications for grants should be made to the Secretary, Biological Laboratories, Harvard University, Cambridge, Mass.

CONFERENCE ON SPECTROSCOPY AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

A SIXTH spectroscopy conference will be held at the George Eastman Research Laboratories of the Massa-

chusetts Institute of Technology on July 18, 19 and 20, repeating the type of program presented at the conferences held during the past five summers. Reports will be given by spectroscopists from university and industrial research and analytical laboratories, and by biologists, geologists, metallurgists, chemists and physicists who have found spectroscopic equipment useful in their investigations.

Morning and afternoon meetings will be held on three days. Papers and discussions on analysis of materials by the emission spectrum, absorption spectrophotometry, photographic photometry, biological and chemical effects of spectral radiation, and industrial applications of spectroscopy, are being prepared. Copies of the detailed program of the conference will be sent on request to anyone interested, but as the attendance at the conference is limited to two hundred, those expecting to attend from a distance are urged to signify in advance their intention of being present. No fee is charged in connection with the conference.

The usual summer courses on practical and applied spectroscopy will be offered at the institute between June 13 and July 23. Requests for fuller information regarding the conference, including titles of the papers to be presented, and for data regarding the summer courses, should be addressed to Professor George R. Harrison, Department of Physics, Massachusetts Institute of Technology, Cambridge, Mass.

AMERICAN ACADEMY OF ARTS AND SCIENCES

At the annual meeting of the American Academy of Arts and Sciences, held on May 11 at its house, 28 Newbury Street, Boston, 37 new fellows and 16 foreign honorary members were elected. Following are those elected to the scientific sections:

FELLOWS

Mathematical and Physical Sciences

Emile Monnin Chamot, Cornell University.
Alfred Victor de Forest, the Massachusetts Institute of Technology.
John Charles Duncan, Wellesley College.
Robert Casad Hockett, the Massachusetts Institute of Technology.
E. Morton Jellinek, Worcester.
John Moyes Lessells, the Massachusetts Institute of Technology.
Harold Clayton Urey, Columbia University.

Natural and Physiological Sciences

Marland Pratt Billings, Harvard University.
Kenneth Vivian Thimann, Harvard University.
George Bernays Wislocki, Harvard University.

FOREIGN HONORARY MEMBERS

Edgar Douglas Adrian, Cambridge, England.

Sir Joseph Barcroft, Cambridge, England.
Emmanuel Fauré-Frémiet, Paris.
Leopold Ruzicka, Zurich.
Nevil Vincent Sidgwick, Oxford.
Georges Urbain, Paris.

The following officers were elected for the coming year:

President, Dugald Caleb Jackson.
Vice-president for Class I, James Flack Norris.
Vice-president for Class II, Walter Bradford Cannon.

Vice-president for Class III, George Grafton Wilson.
Vice-president for Class IV, Arthur Stanley Pease.
Corresponding Secretary, Leigh Hoadley.
Recording Secretary, Hudson Hoagland.
Treasurer, Horace Sayford Ford.
Librarian, Hervey Woodburn Shimer.
Editor, Charles Henry Blake.

Professor George D. Birkhoff spoke on "Mathematical Advances Since 1900 and Their Influence on Scientific Thought."

SCIENTIFIC NOTES AND NEWS

THE Priestley Medal of the American Chemical Society, awarded for distinguished service to chemistry, will be conferred upon Dr. Marston Taylor Bogert, professor of organic chemistry at Columbia University, at the Milwaukee meeting of the society.

DR. CHARLES FRANCIS BÖDECKER, professor of histology and embryology in the College of Dentistry, Columbia University, was presented with the William Jarvie fellowship medal at a dinner of the New York State Dental Society on May 11. The medal is presented annually to the dentist who "has contributed results of original research or whose high attainments and high standing have been of such character as to have aided and advanced materially the science and art of dentistry."

THE Manson Medal of the Royal Society of Tropical Medicine and Hygiene has been awarded to Major-General Sir Leonard Rogers, retired, and will be presented at the annual general meeting of the society on June 16. The medal is awarded triennially "to the living author of such work in any branch of tropical medicine or tropical hygiene as the council may consider to be deserving of the honor."

ON the occasion of the eleventh Congress of the German Society for Investigation of the Circulation, recently held at Bad Nauheim, Professor Hess of Zürich was awarded the Carl Ludwig Medal, and Professors Spalteholz of Zürich, Jaksch of Prague, Geheimrat Aschoff of Freiburg and Hering of Kiel were named honorary members of the society.

THE second volume of the Collected Works of Professor G. A. Miller, published by the University of Illinois, is in press and is expected to appear during the coming summer. It contains publications issued from 1900 to 1908 in addition to two articles written specially for this volume and relating, respectively, to the history of group theory during the period covered by this volume and the general history of mathematics.

THE honorary degree of doctor of science will be conferred on June 9 by the University of Cambridge

on Dr. Francis Peyton Rous, of the Rockefeller Institute for Medical Research, New York.

DR. ELMER V. MCCOLLUM, professor of biochemistry and head of the department at the School of Hygiene and Public Health of the Johns Hopkins University, recently delivered the Gordon Bell Memorial Lecture, at a special convocation at the University of Manitoba, Winnipeg. The university conferred on Dr. McCollum the degree of doctor of laws.

AMONG honorary degrees to be conferred by the University of St. Andrews will be the doctorate of laws on Dr. E. D. Adrian, Foulerton research professor of physiology and fellow of Trinity College, Cambridge; on Professor R. G. Collingwood, Wayflete professor of metaphysical philosophy and fellow of Magdalen College, Oxford, and on Sir Gilbert Morgan, head of the Chemical Research Laboratory, Teddington. The university had indicated its intention to confer the degree on Dr. R. Tait McKenzie, emeritus professor of physical education in the University of Pennsylvania, who died on April 28.

DR. A. H. GORDON, professor of medicine at McGill University and senior physician of the Montreal General Hospital, was elected president of the American Clinical and Climatological Society at the recent meeting of the society in Atlantic City.

THE South Dakota Academy of Science held its annual meeting at Yankton College on April 29 and 30. The guest speaker was Dr. David D. Whitney, professor of zoology at the University of Nebraska, who spoke on "Heredity in Man." The officers elected for 1938-39 are: *President*, Dr. Ward L. Miller, State College, Brookings; *First Vice-president*, Dr. Walter V. Searight, University, Vermillion; *Second Vice-president*, Dr. A. L. Moxon, State College, and *Secretary-Treasurer*, Professor A. L. Haines, University, Vermillion.

DR. JAMES FRANCK, of the Johns Hopkins University, has been appointed professor of physical chemistry at the University of Chicago. Dr. Franck's ap-

pointment was made possible through a grant of \$20,000 a year for a period of ten years from the Samuel S. Fels Fund, founded by Mr. Samuel S. Fels, of Philadelphia. The fund provided for the salaries of Dr. Franck, two assistants, technicians and \$12,000 for special equipment. Dr. Franck, who was appointed professor of physics at Göttingen in 1920, remained there until the day Hitler assumed power, when he resigned. After six months without a position he moved with his family to Copenhagen, where he was given an appointment at the university. He remained there for a year, after which he accepted his present position of professor of physics at the Johns Hopkins University.

DR. GEORGE EUGENE UHLENBECK, for the last four years professor of theoretical physics of the University of Utrecht, previously associate professor of physics in the University of Michigan, has been appointed visiting professor of theoretical physics at Columbia University.

IN the department of botany of the University of Oklahoma, Dr. George L. Cross, associate professor and acting head of the department, has been promoted to a professorship and has become head of the department; Dr. Orie J. Eigsti, professor of biology at Greenville College, Illinois, has been appointed assistant professor of botany, and Dr. H. L. Chance has been promoted from an assistant professorship to an associate professorship.

DR. OSKAR BAUDISCH, director of the research division of the Saratoga Springs Commission, State of New York, has been appointed associate in biochemistry at the Albany Medical College. He will continue his connection with the Saratoga Springs Commission.

PROFESSOR B. MOUAT JONES, of the University of Manchester, has been appointed vice-chancellor of the University of Leeds in succession to Sir James Baillie, who has reached the age of retirement. Professor Jones has been for seventeen years principal of the Manchester College of Technology and dean of the faculty of technology of the University of Manchester.

DR. ROBERT C. MILLER, professor of zoology in the University of Washington, has been elected director of the museum and of the Steinhart Aquarium of the California Academy of Sciences, the appointment to take effect on September 1.

SIR GEOFFREY EVANS, who has been principal of the Imperial College of Tropical Agriculture, Trinidad, since 1927, has resigned in order to accept a post as economist and botanist at Kew Gardens.

DR. JULIAN H. STEWARD, ethnologist of the Smithsonian Institution, is on his way to South America, where he will spend approximately eighteen months in

a study of three Indian tribes. The first stop will be among the Otavalo Indians of northern Ecuador. These people are of the general Quechua stock to which the Incas of Peru belonged. A few months will be spent among the Campas Indians of eastern Peru. The primary objective of the expedition, however, will be a study of the ethnology of the Araucanian Indians of Chile, never actually conquered either by the Incas or the Spaniards.

DR. HAROLD ST. JOHN, professor of botany at the University of Hawaii and botanist of the Bishop Museum, Honolulu, has received a grant from the Carnegie Corporation which makes possible a botanical expedition to Rotuma. Rotuma lies about 400 miles north-northwest of Suva and is a volcanic island with hills 800 feet high. It comes within the museum's sphere of botanical interest, and the expedition will make it possible to close a gap in the botanical record of the Pacific islands. Dr. St. John will leave Honolulu for Suva on May 30.

C. G. PAULSEN returned to Washington at the end of April, after spending several weeks visiting district offices of the Geological Survey in the West. While in California, he made arrangements for rehabilitating many of the survey river measurement stations destroyed or damaged by the recent floods and also made preliminary arrangements for the preparation of a comprehensive report on these floods.

DR. FOREST RAY MOULTON, permanent secretary of the American Association for the Advancement of Science, gave an illustrated address entitled "Cataclysms" on May 13 before the Rittenhouse Astronomical Society of Philadelphia.

THE fifth and final meeting of the American Institute Symposium on "The Social Implications of Science" was held recently at the Aldine Club, New York, under the chairmanship of Dr. John C. Merriam, president of the Carnegie Institution of Washington. Other speakers were Dr. Benjamin C. Gruenberg and John J. O'Neill, science editor of *The New York Herald-Tribune*.

DR. FREDERICK L. HISAW, professor of zoology at Harvard University, will give the commencement address at the University of Missouri, of which he is a graduate, on June 7.

DR. VILHJALMUR STEFANSSON, the Arctic explorer, will deliver the commencement address at the University of Pittsburgh on June 8.

THE Academy of Medicine of Washington, D. C., held its spring meeting on May 14. Following the usual dinner, Dr. Winfred Overholser, professor of psychiatry in the George Washington University School of Medicine and superintendent of St. Eliza-

beth's Hospital, gave an address entitled "The Psychiatrist in Court."

THE Croonian Lectures of the Royal College of Physicians of London will be given by Professor F. R. Fraser on May 24, 26 and 31. His subject will be "The Clinical Aspects of the Transmission of the Effects of Nervous Impulses by Acetylcholine."

At the Dallas meeting of the American Chemical Society it was reported that as yet there had been very little retardation in its work on account of the present recession. On April 1 the society had 21,689 members, an increase of 1,730 over the same date in 1937. Subscriptions to the journals have likewise increased. On the basis of April 1, 1937, to April 1, 1938, the *Journal of the American Chemical Society* has increased by 427 subscribers; *Chemical Abstracts*, by 482; the *Industrial Edition of Industrial and Engineering Chemistry*, by 1,386, and the *News Edition*, by 2,202. The actual paid membership of the society was 1,426 greater on April 1, 1938, than on April 1, 1937, which, in view of the increased total membership, indicates that payments are falling off slightly in percentage as a result of the depression. The new procedure adopted in 1937 establishing groups of student affiliates throughout the country has proved a success. There are now 16 chapters of student affiliates, with, as of April 11, 499 members.

THE annual spring meeting of the Oklahoma Academy of Science was held at Craterville Park in the Wichita Mountain range on April 22 and 23. Approximately three hundred members were present. Two evening meetings were held in which lectures were given by scientific men in the state. Field trips of interest to botanists, zoologists, geologists, ecologists and limnologists were conducted during the two days of the meeting. A resolution that a large portion of the Wichita Mountain Wild Life Refuge in Oklahoma be permanently closed to domestic live-stock, public thoroughfares and other interferences and disturbances was passed. The meeting was in charge of Dr. F. A. Fenton, Stillwater, vice-president of Section A of the American Association for the Advancement of Science.

THE Western Reserve University chapter of Sigma Xi held its annual meeting with the initiation of new members on May 11. After the dinner for members there was a lecture by Dr. O. L. Inman, director of the C. F. Kettering Foundation of Antioch College, which was open to the public. Dr. Inman spoke on "Chlorophyll and Photosynthesis." Dr. Webster G. Simon, dean of liberal arts and sciences at the university, presided at the dinner. The following officers were installed for next year: *President*, Dr. Torald Sollmann, dean of the School of Medicine; *Vice-president*, Dr. Frank Hovorka, associate professor of

chemistry; *Secretary*, Dr. James Clarke Gray, assistant professor of biology, and *Treasurer*, Dr. Leroy D. Edwards, assistant professor of pharmacognosy and pharmacology.

THE following resolution, drawn by a committee consisting of Drs. McKeen Cattell, E. M. K. Geiling, O. S. Gibbs, George B. Roth and C. W. Muehlberger, *chairman*, was passed by the American Society for Pharmacology and Experimental Therapeutics at its meeting in Baltimore on April 2: "The American Society for Pharmacology and Experimental Therapeutics views with alarm the lack of statutory regulation of the sale and use of dangerous therapeutic preparations, which result in such tragedies as the recent series of deaths from 'Elixir of Sulphanilamide' and from contaminated serum. Furthermore, the present and increasing promiscuous use by the public and especially by the youth of this country, of drugs which have either a pronounced stimulating effect or a profound depressing effect upon the nervous system is an alarming situation calling for immediate remedial measures in the interest of public health and safety. *Therefore*, the American Society for Pharmacology and Experimental Therapeutics in annual meeting assembled, respectfully but firmly urges that the governmental authorities, through Congress, be given the necessary power to regulate the use by or sale to the general public of such preparations as are dangerous or inimical to the public health and safety. *Be it further resolved*, that new or untried drugs should not be allowed to come into use by the general public before authoritative sanction has been obtained. *Be it further resolved*, that copies of this resolution be sent to all appropriate governmental and medical organizations."

AN international postgraduate course in malariology will be held in Rome from July 18 to September 17; the language used will be French, and interpreters will be available for those taking part in it. Excursions in connection with the course will be made to various sanitary stations near Rome, Ostia, Venice and Sardinia. Further details may be obtained from Professor G. Bastianelli, Istituto di Malariologia, Ettore Marchiafava, Policlinico Umberto I, Rome. The annual malaria control course for laymen engineers (engineers, planters, etc.), will open at the Ross Institute of Tropical Hygiene, London, on June 27. It will be under the direction of Sir Malcolm Watson, director of the institute, and will last five days. The course is free.

THE National Research Council has recently subscribed to a table in the Stazione Zoologica di Napoli. Biologists desiring to avail themselves of the use of this table in the near future should write immediately

to the Division of Biology and Agriculture, National Research Council, Washington, D. C. The award of the table will be in the hands of a committee of the division, consisting of the representative to the division from the American Society of Zoologists, *Chairman*, the president of the American Society of Zoologists, the president of the Botanical Society of America and the chairman of the Division of Biology and Agriculture of the National Research Council, *ex officio*.

NINE Charles A. Coffin fellowships, amounting in all to \$5,000, for advanced scientific research, have been awarded by the General Electric Company. The students will carry on their work at the Massachusetts Institute of Technology, the University of Chicago, Yale University, the University of Cincinnati, the University of Rochester and the University of Virginia. Five of the recipients of the fellowships are engaged in physics as their field of research, three in electricity and one in physical chemistry. The fellowships are awarded each year to graduates of colleges in the United States who have shown by the character of their work that they could with advantage undertake or continue research work in educational institutions either in this country or abroad.

RESEARCH fellows have been selected for work at the Westinghouse Research Laboratories in East Pittsburgh as follows: Robert O. Haxby, research assistant in physics at the University of Minnesota, W. E. Shoupp, of the University of Illinois, and W. E. Stephens, of the California Institute of Technology, will continue researches on nuclear physics; John A. Hipple, graduate student at Princeton University, plans to design and construct a large mass spectrograph of high resolving power for studies in molecular structure; Sidney Siegel, of Columbia University, will study the elastic properties of alloys. The five appointments are the first to be made under a plan announced last December, whereby the Westinghouse Electric and Manufacturing Company plans to support the work of ten young physicists on fundamental studies broadly related to the electrical industry. The fellows are appointed for one year and are eligible for one reappointment. The men will work under the general supervision of Dr. E. U. Condon, associate director of the laboratories.

ACCORDING to statements made in the daily press, by the will of Henry W. Putnam, New York wire and glass manufacturer, who died on March 30, the sum of \$3,000,000 is left to the Henry W. Putnam Memorial Hospital, Bennington, Vt. In addition to the specific bequests a residuary trust of an undetermined amount is established, in which Harvard University, Yale University and Princeton University will share equally after the death of four cousins who will draw interest from it for life.

It is reported that Bucknell University has received gifts amounting in all to \$125,000 toward a new engineering building. These gifts are in addition to a gift of \$50,000 contributed in the autumn.

THE New York Academy of Medicine has announced that a sum of approximately \$1,000 is available under the Edward N. Gibbs Memorial Prize toward original research in diseases of the kidney during 1938. Candidates, who must be physicians who have been graduated at least three years and be residents of the United States, shall submit "evidence of research already performed and of facilities to prosecute research upon the causation, pathology and new methods of treatment of diseases of the kidney." The award may be continued through not more than three years to any one individual. Applications with the required evidence should be addressed to the New York Academy of Medicine prior to June 1.

SIGMA PI SIGMA, physics honor society, installed its thirty-fourth chapter at the University of Pittsburgh on April 8. Present at the installation were: Dr. R. C. Colwell, West Virginia University, *national president*; Dr. Marsh W. White, Pennsylvania State College, *executive secretary*, and Dr. F. C. Blake, of the Ohio State University, *member of the executive council*. Dr. Edward U. Condon, associate director of research at the Westinghouse laboratories, was received into the society as an honorary member. Following the installation banquet at Webster Hall, Dr. Condon addressed an open meeting of the chapter at the Mellon Institute on "Recent Developments in Quantum Mechanics."

THE fifth biennial convention of the Alpha Epsilon Delta Honorary Premedical Fraternity was held at the University of North Carolina from March 24 to 26. The North Carolina Beta Chapter acted as host to eighty-five visiting members and delegates from twenty-one chapters in fourteen states. One of the most important reports made was on the success of the social hygiene programs among the college students reported by the various chapters. An illustrated lecture was given by Dr. Addison G. Brenizer, of Charlotte, N. C., on "Surgical Anatomy of the Thyroid Gland and Thyroidectomy," and at the banquet on Saturday evening, Dean Wm. deB. MacNider, of the Medical School, spoke on "The Biologically-Minded Physician." Officers elected to the grand staff were as follows: *Grand President*, Dr. Charles F. Poe, professor of chemistry, University of Colorado; *Grand Vice-President*, Dr. K. P. Stevens, professor of biology, Central College; *Grand Secretary-Historian*, Dr. Maurice L. Moore, Drexel Hill, Pa.; *Grand Treasurer*, Dr. Warren H. Steinbach, professor of chemistry, University of Arkansas. Members elected to the executive council were: Dr. Emmett B. Carmichael, professor of physiological chemistry, University of Alabama; Dr.

H. R. Henze, professor of chemistry, University of Texas, and Dr. R. W. Bost, professor of chemistry, University of North Carolina.

THE annual dinner of trustees, faculty and staffs of the New York Medical College and Flower Hospital and the New York Ophthalmic Hospital was held at the Waldorf-Astoria Hotel on March 18. The speakers were: Dr. Arvid Lindau, professor of pathology and bacteriology at the University of Lund, Sweden, and Dr. Fordyce Barker St. John, professor of clinical surgery at the College of Physicians and Surgeons of Columbia University. Dr. Lindau's topic was "The Pathogenesis of Gastric Ulcer." Dr. St. John gave an illustrated lecture on "The Surgical Treatment of Gastric Ulcer." Dr. Harold D. Harvey, associate in surgery at the College of Physicians and Surgeons, assisted Dr. St. John. In connection with the Swedish Tercentenary of the settling of New Sweden on the Delaware River, a second lecture was given on May 2 in the Hecksher Foundation Theater by Dr. Einar Hammarsten, professor of chemistry at the Carolingian Medical University at Stockholm. His subject was "The Duodenum and Its Associates, the Important

Hormonal Centrum." A recent bequest of \$100,000 has been granted to the Fifth Avenue Hospital through the will of the late Adolph L. Gondran. Legacies of \$10,000 each also have been received recently by the Flower Hospital and the New York Medical College and Flower Hospital through the will of Mrs. Sophie M. Gondran.

FOLLOWING the falling of possibly a ton of plaster and timber in an unoccupied classroom in University Hall at the University of Illinois in January, inspection determined that other parts of the building were unsafe and it was closed until a complete examination could be made. Later the trustees closed the building permanently. Governor Henry Horner, after a personal inspection trip, agreed with the trustees' action and indicated that he would include in his call for a contemplated special session of the State Legislature a request for funds to build a building, or buildings, to duplicate the floor area of the vacated building. The trustees are conducting a study to determine whether one large new building will meet the needs of the university, or whether it would be more expedient to build two smaller structures.

DISCUSSION

A COLONY OF ALBINO RATS EXISTING UNDER FERAL CONDITIONS

OTHER than brief references^{1,2} of uncertain significance, the only observation of albino rats existing in a feral state appears to be that of Svihla.³ Donaldson's attempts to establish wild colonies of white rats met with little success.^{4,5,6} So it seemed of unusual interest to find a large colony of albino rats which had been well established for a number of years in a dump-ground near Missoula, Montana. These rats were considered a health menace, so measures were taken to exterminate them.

The albino rats inhabited an area of about an acre and a half which was built up as a shelf of debris filling in a back-water slough along a river bank. Earth and gravel were dumped on the debris making a thoroughly honeycombed fill some twenty feet in depth. The south side of the shelf sloped to the river, and over this bank the daily city refuse was dumped. Thus food, water and shelter were provided for the rats.

¹ S. Moss, *Mag. Nat. Hist.*, London, 9: 182-185, 1836.

² J. Rodwell, "The Rat," G. Routledge and Co., London, 1858.

³ A. Svihla, *Am. Nat.*, 70: 403-404, 1936.

⁴ H. H. Donaldson, *Jour. Acad. Nat. Sci. Phila.*, 15: 365-369, 1912.

⁵ H. H. Donaldson, *Year Book, Carnegie Institution, Washington*, 15: 200-201, 1916.

⁶ H. H. Donaldson, "The Rat," 2nd Ed., Wistar Institute, Philadelphia, 1924.

The animals were first noted in large numbers at the dumpground in the summer of 1935. Their source is obscure, but it is presumed that some student from the University of Montana in Missoula released white rats at the dump as a means of disposal. By the summer of 1936 the rats had proliferated so remarkably that a poisoning campaign was instituted, which served to cut down their numbers. The program was not extensive enough to destroy the colony, so, by the following spring (1937) they were very numerous. We have estimated that 2,000 rats were feeding at one time.

The winter habits of these rats have not been observed. Since the river freezes over each winter, it is assumed that the rats' water supply was from that welling up from beneath the fill. The depth of the bank was ample to permit them to remain below frost line yet far enough above water to be dry. There was food enough for winter storage and new refuse was added daily. It is possible that the newly dumped refuse afforded a source of heat for the colony. In any event, the colony was observed to survive two winters, during which time the outside temperature was as low as 25 degrees below zero (Fahrenheit), and several protracted sub-zero spells were recorded.

During the summer the rats fed early in the morning and in the evening, remaining in their burrows through the heat of the day. They had established

several large feeding places and a network of runs to these from the burrows. Apparently they seldom left the beaten paths, and bait placed only a few inches off the route was never taken. Even the addition of codliver oil to the bait had little attracting power. It seemed necessary for the animals to come directly upon the food, almost touching it, before they were aware of its presence.

The animals exhibited some rather peculiar responses to the poisons used during the campaign. The usually recommended poisons^{7,8} (prepared rodent poison and red squills) were found to be of the least value. This might be explained by the fact that the procedure had to be varied according to the habits of the animals. Barium carbonate, with meat and codliver oil, proved to be an efficient poison and was invariably effective on control rats in 8 to 12 hours. The recommended mixture of red squills had no effect whatever on controls. When mixed in higher percentages the rats would not take the bait satisfactorily. Strychnine-treated oats, prepared as rodent poison by the U. S. Biological Survey Station in Boise, Idaho, and distributed by the local county agent, were without effect on control rats. The most satisfactory poison was that prepared in the Missoula Health Department laboratory, consisting of strychnine-treated oats sweetened with Karo syrup and saccharin. This was safe to use and invariably effective within a few minutes.

Throughout the course of the extermination campaign rats were examined for signs of disease. Inspections for tularemia and plague lesions were negative. Fleas were rare. Liver cysts, in which scoleces were demonstrable, were found in several rats, and a few animals were seen with crusted eyes and the symptoms of the common mouse-pneumonia. A relatively large number showed hair loss, which might be the result of a diet deficiency, or perhaps due to parasitic infection. A large number, particularly among the younger rats, appeared to be rachitic.

The observations on this colony seem to indicate that albino rats, although supposedly weakened by years of domestication, are able to maintain themselves outdoors and to resist extermination. The absence of predatory animals, particularly the gray Norway rat, is probably an important factor in explaining the survival of the colony. It seems apparent, then, that food and water, underground shelter and absence of predatory animals comprise an environment suitable to the continued existence of albino rats under non-domestic conditions.

⁷ W. C. Rucker, in "The Rat and its Relation to the Public Health," Gov't. Printing Office, Washington, pp. 153-162, 1910.

⁸ J. C. Munch, J. Silver, E. E. Horn, *Jour. Am. Pharmaceut. Assn.*, 19 (8): 837-840, 1930.

SUMMARY

(1) A colony of albino rats existing under non-domestic conditions has been observed in Montana. The colony is known to have survived two winters.

(2) Some peculiarities in their habits and responses to common poisons are pointed out.

(3) Albino rats appear to be able to survive extreme weather conditions and to resist extermination from causes such as disease and unfavorable diet.

(4) The absence of predatory animals, particularly the gray Norway rat, is probably an important factor in the survival of the colony.

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CENTRIPETAL DRIFT: A FALLACY IN THE EVALUATION OF THERAPEUTIC RESULTS

THE fallacy to be described here has been observed twice in recent numbers of carefully edited medical journals,¹ and for that reason alone deserves the attention of investigators. It is likely that a search of the literature of therapeutics would yield numerous instances.

Using an instrument whose readings are affected by large chance errors, an investigator examines, say, 100 subjects. He selects the 10 people whose performance on the test happens to be the poorest, and gives them some kind of treatment. Next day he reexamines the 100 subjects. The average performance of the 100 is exactly what it was the day before, but the 10 who did most poorly then are now found to have improved strikingly.

To illustrate the principle involved, one may take 10 playing cards numbered consecutively from 1 to 10. One shuffles and distributes the cards among 10 people, here identified by the letters A to J:

A	B	C	D	E	F	G	H	I	J
3	7	4	6	2	9	8	10	1	5

One may express sympathy for A, E and I, who did so poorly on the test, tell them it must be the lack of vitamins in their diets and administer any desired treatment, such as the laying on of hands. Then the cards are again shuffled and distributed:

A	B	C	D	E	F	G	H	I	J
7	2	5	6	8	3	9	1	4	10

This time B, F, and H happen to hold the low cards,

¹ H. Jeghers, *Jour. Am. Med. Assn.*, 109: 756, 759, September 4, 1937. M. B. Corlette, J. B. Youmans, H. Frank and M. G. Corlette, *Am. Jour. of the Med. Sciences*, 195: 58, 59, 62, 63, January, 1938.

while A, E and I are found to have improved strikingly. It is even possible to show that the improvement is statistically significant, for their average before treatment was 2.00 ± 0.38 , while after treatment it was 6.33 ± 0.80 .

The shuffling of the cards and the subsequent dealing are, of course, analogous to the taking of measurements by means of instruments so poor, or under conditions influenced by so many uncontrolled variables, that the readings are completely determined by chance. But it is evident that the phenomenon must be at work whenever one works with tests whose results have a perceptible degree of chance error. This is the case with many of the tests used in biochemistry, physiology and psychology. This phenomenon must be suspected of being at work whenever one finds that the "super-normals" selected by the same test (subjects F, G and H in the above illustration) are adversely affected by the therapy. This fact, that *both* extremes on re-examination are found to gravitate in the direction of the mean for the whole group, suggests the name "centripetal drift" for the phenomenon.

A remarkable thing about this fallacy is that it can not be avoided by taking more readings on the subjects of the experiment. Thus one may deal the cards *twice*, and average the results:

	A	B	C	D	E	F	G	H	I	J
1st	3	10	2	8	7	4	9	6	5	1
2nd	6	2	10	7	9	1	3	8	4	5
Ave.	4.5	6	6	7.5	8	2.5	6	7	4.5	3

The four lowest are A, F, I and J. After treatment one again deals the cards twice:

	A	B	C	D	E	F	G	H	I	J
1st	8	2	5	6	7	9	3	4	10	1
2nd	4	1	2	6	9	8	5	7	3	10
Ave.	6	1.5	3.5	6	8	8.5	4	5.5	6.5	5.5

The experiment has now been done more carefully than before, and the improvement shown by A, F, I and J is very convincing; their average before treatment was 3.62 ± 0.44 , and after treatment it was 6.62 ± 0.82 .

One way to avoid the fallacy of the centripetal drift is to compute the index of reliability of the instrument by the method of self-correlations.² When this method is applied to the last set of readings above (8 and 4, 2 and 1, 5 and 2, etc.) one obtains an index very near zero; a very reliable instrument gives readings whose index is very near one. Some instruments used clinically give disturbingly low indexes.

Another way to avoid the fallacy is the time-honored device of dividing the subnormal group itself into a treated and an untreated (control) group.

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² H. Sorenson, "Statistics for Students of Psychology and Education," New York, McGraw-Hill, 1936, p. 339ff.

THE CONCEPT OF ATAVISM

DURING the days when biologists were sedulously engaged in supplying the finishing touches to the house that Darwin built, it was the usual practise to regard every possible arrest in development or unusual character of an organism as the persistence or recurrence of an erstwhile normal feature of the particular organism's ancestor or ancestors. Such a reversion to the presumed ancestral condition was termed an *atavism*, from the Latin *atavus*, an ancestor. This concept, and the term expressing it, abounds in the writings of nineteenth century biologists. Haeckel's Biogenetic Law really represents a generalized synoptic version of this concept applied to a particular case, and calculated to resume a certain supposed routine of phenomena under a particular law. To-day few biologists believe that in its ontogenetic development any animal actually repeats the developmental stages of its phylogenetic history. In development the organism apparently passes only through those stages of development which are akin to similar stages passed through in the *ontogenetic* development of its ancestors; and this is essentially what von Baer said in his Hypothesis of Recapitulation, which is not to be confused with the so-called Biogenetic Law. In development the organism does not repeat the *adult* stages of its ancestors, but only those stages of development through which its ancestors as a whole have, more or less, in common passed. This, as von Baer originally pointed out, is why the early stages of related animals resemble one another more closely than do the differentiated adults. Modern recognition of these facts has brought the Biogenetic Law into disrepute.

The conception of atavism, however, persists. Reference to many modern texts on embryology, general biology and the writings of a fair number of morphologists, will supply examples of the uncritical usage of this term. One recent work by a notable worker has a section entitled "Reappearance of Lost Ancestral Structures in Man," and as the example of such structures we are given "the gill-pouches . . . [of] the early embryo . . . [which] may . . . persist and form an open fistula on the side of the neck." Surely, it is clear that such a fistula is due to the mal-development or arrest in development of an embryonic character of the individual and not to the reappearance of a character which the species and class has lost but which may have been present in some remote phyletic ancestor. In this connection it is worth drawing attention to the fact that the conventionally accepted homology between the gill-pouches or arches of fishes and the branchial arches of mammals is open to serious question.¹

¹ E. Gaupp, *Ergeb. Anat. u. EntwicklGesch.*, Bd. 14, p. 808, 1905; A. C. Bruni, *Arch. Ital. Biol.*, vol. 51, p. 11, 1909; G. R. De Beer, "The Development of the Vertebrate Skull," Oxford, p. 406, 1937.

The occasional occurrence of a "tail" in man or of an azygos lobe of the right lung, microcephaly, large canine teeth, the fourth molar, the divided malar bone, the "third trochanter" of the femur, the entepicondylar foramen of the humerus, supernumerary mammae and many other characters have been, and still are, cited as examples of atavism. Yet in every case it can be conclusively shown that such characters are not upon any view to be regarded as reversions to an ancestral condition. Changes in development and in developmental rates resulting in persistence, suppression, reduction, hypertrophy, duplication or multiplication of structures and normal variability, are processes quite adequate to account for the so-called "atavisms" which are commonly cited.

In short, it is more than doubtful whether the concept of atavism has any counterpart in reality; and, I think it will be agreed, that unless the concept can be applied to some demonstrable type of phenomenon, it were better that the term were altogether dropped from the vocabulary of the biologist.

M. F. ASHLEY-MONTAGU

NEW YORK UNIVERSITY

BIOLOGICAL ABSTRACTS HAS GONE TO PRESS

Biological Abstracts has been saved! Funds for Volume 12 are pledged in sufficient amount to guarantee publication.

The first number of Volume 12 went to press on April 19, and will consist mostly of abstracts appearing in the last half of 1937, together with a few from 1938. The second number will follow close on the heels of the first, appearing before June 10, and will consist of 1938 material. It is planned that Number 3 will be a supplement, and will bridge the gap between Volumes 11 and 12. Thereafter publication will be prompt. The indices to Volumes 10 and 11 are likewise provided for. Over one half the index of Volume 10 is already through galley proof.

The budget adopted has been set at the lowest figure consistent with this worthy project. Under it some 15,000 abstracts are planned. A list of journals will be published in an early issue. It is planned to extend

the scope of *Biological Abstracts* as subscriptions are added. To insure satisfactory coverage, steps are being taken to secure the appointment of advisers from the various biological organizations having a stake in the enterprise.

The Board of Trustees, taking office as an emergency measure in mid-February with ten months of the fiscal year gone, are deeply grateful for the prompt and generous response given their appeals a month later in *SCIENCE* and the *Library Journal*. They regret the unfortunate features of the plan under which the present funds have been solicited, and pledge their energy to the liquidation of that plan at the earliest possible moment. The new editor-in-chief, Dr. John E. Flynn, is keenly aware of the problems facing *Biological Abstracts*, and is very eager to do his bit in keeping this journal up to the minute and in making it a more useful one.

Now that publication has been resumed, it is hoped that institutions and individuals will forward their orders at once. This is particularly necessary if they wish to avoid interruption of their files, since the edition must be kept reasonably close to the subscription list. That their institutions are saddled with various subsidies is lamentable, but the Board of Trustees promises relief in another year in the case of *Biological Abstracts*.

The present Board of Trustees has been maintained intact during the current emergency. While the membership has been criticized because of too great concentration in certain states, this has been a distinct advantage when personal consultations were needed. Committees have been appointed, however, to study the problem of a more satisfactory geographical distribution, together with other pertinent problems.

Biological Abstracts is yours. Its success depends upon an active interest taken by you and the societies of which you are a member during the coming years. If you do this, a creditable journal can be confidently forecast.

GEORGE W. HUNTER, III, *Chairman*

PAUL R. BURKHOLDER

M. L. RANEY

Executive Committee

QUOTATIONS

SCIENCE AND SOCIETY

THE correspondence shows a remarkable consensus of opinion. Practically all are agreed that some organized body is necessary which shall study the problems, many of them highly controversial, evoked by the impact of science on society, in an objective and

rational manner. Such a body must have the closest linkings with the physical and biological sciences, with economics, engineering, psychology, anthropology and sociology. It must provide a platform for free and frank debate; it should conduct its investigations as much by means of research committees and discussions

as by the formal reading of papers; it should endeavor to make its findings plain to the man in the street.

There can be no question as to the need for such work to be undertaken. The present age is deafened by the cries of advertisers of nostrums of all kinds; and those of us who believe that, before all and above all, reason, and conviction by an appeal to reason, are the indispensable bases for any ordered, successful and permanent social advance, can not but be alarmed at the growing tendency to explosions of mass-hysteria. It is only when reason provides the outlook that the emotions may be trusted to control the direction. In a society such as is proposed it is of the first importance that its explorations should be conducted and its conclusions reached in a detached and cool spirit. Coolness does not mean coldbloodedness nor does it connote any hesitation in pursuing the right path once that path is known.

The main problem being one of the interaction of science and social relations, it is clear that, as Professor Ginsberg has put it, "the study of the effects of science on social relations requires not only a knowledge of science, but also of social relations." The problems are, in fact, sociological, and the society which undertakes the task of studying these repercussions must have a very wide field on which to draw. It may be that the ends in view will best be served by the formation of a new society charged with the special task of surveying and interpreting the social relations of science, but before actually constituting such a society, the British Association, itself a pioneer in the attack on some parts of the problem, might be invited to undertake the task.

As some correspondents have pointed out, the annual meeting of the association provides an admirable platform from which to announce progress, but that much more than this is needed: and much more is possible. Already the association is enlarging its activities to meet the changing needs of a changing era. It has initiated, in many of its sections, papers and discussions which touch upon these topics; it has taken part in the jubilee meeting of the Indian Science Congress Association, recently held in Calcutta, thereby establishing an important principle of overseas delegations. At the present moment its general

officers are in consultation with their colleagues of the American Association for the Advancement of Science on a scheme for international cooperation such as that association has recently adumbrated. The association possesses sections the work of which touches closely that of a society for the study of social relations, and it is second to none in its experience of the manner of work of research committees. Is it too much to suggest that the association might very well consider the arranging of discussions of these problems to be held in London or elsewhere at regular intervals outside the annual meeting? For the organization of such meetings, and the undertaking of appropriate investigations by research committees, an entirely new department of the association might be constituted. It seems to us that this plan would be preferable to the addition of a new section, or subsection, to deal with the social relations of science.

A new society of the kind contemplated implies much more than an annual report; and if the British Association accepted responsibility for its functions, either by the formation of a new department or otherwise, the present annual report would have to be supplemented by a new periodical publication comparable to the proceedings or journals of other societies, and devoted mainly to the advancement of knowledge of the impact of science on society and of society on science.

It may be that the serious questions of finance and of policy involved will make it too difficult for the association to undertake this work. But in its constitution and outlook it is at least a possible body to undertake such duties, and its long and brilliant traditions are sufficient guarantee that the work, if undertaken, will be carried out in the true spirit of science and of public service. We suggest, therefore, that when a meeting is held to discuss proposals for constituting a body to organize inquiries into the social relations of science and publish the results, the possibility that the association might accept this responsibility should be considered. Even if the association fails to do so, for financial or other reasons, it might in many ways assist the work of any new society which may be formed.—*Nature*.

THE NATIONAL ACADEMY OF SCIENCES. II

ABSTRACTS OF PAPERS

The morphogenetic significance of the tonic-neck-reflex in the early patterning of human behavior: ARNOLD GESELL (introduced by W. R. Miles). The tonic-neck-reflex has been chiefly studied in quadrupeds, as a specific postural reaction in which aversion of the head induces (proprioceptively) an extension of one forelimb and a flexion of the other. Observations at the Yale Clinic of Child De-

velopment show that the counterpart of this postural attitude is a prominent and pervasive feature of infant behavior, particularly in the first four weeks of life. The data include (a) dictated observations of the spontaneous supine activity of 26 or more infants at 4, 6, 8, 12, 16 and 20 weeks of age; (b) cinema records of selected infants at these ages; (c) daily observations of one infant in the neonatal period; (d) cinema records

and neuropathological findings in a case of double athetosis from basal birth injury of the brain. Cinema records were subjected to frame by frame analysis to determine the frequency and the serial components of the t-n-r phenomena. At four weeks of age the classic t-n-r attitude is almost invariably present in the waking infant. At sixteen weeks the head is no longer prevalently averted, but maintains a mid-position, with increasing symmetry of arm posturing. This postural transformation involves far-reaching growth changes in eye-hand coordination, ocular fixation, prehension and, indirectly, locomotion. In the human species, the t-n-r is not a specific stereotyped reflex, but the framework and matrix for extensive developmental elaborations. Consistent individual differences in t-n-r manifestations denote differences in laterality, motor demeanor and psycho-motor constitution.

Influence of simple trial-and-error learning on the strength of the component habits: CLARK L. HULL. An albino rat is first trained to secure standard food units by pressing a vertical bar sidewise, and, second, is trained to a much stronger degree to secure the same food by pressing a horizontal bar downward. Simple trial-and-error learning results when the animal is presented with both bars, the apparatus so adjusted that only the functioning of the weak habit will yield food. The problem is to study independently the presumptive weakening of the strong habit and the presumptive strengthening of the weak habit as the latter gradually becomes dominant. This is done by measuring the strength of each habit just before the trial-and-error learning and again immediately afterwards. The criterion of habit strength is the number of times the animal will continue to press the bar without getting food reward. Distinct groups of comparable animals are employed for each of the four types of determination. Experimental results indicate that, in conformity with theoretical expectation, trial-and-error learning strengthens the weak habit. The effect on the strong habit is more complex and the outcome is still in doubt.

The camel-like ruminants of North America: WILLIAM B. SCOTT. At the present time the two divisions of the camel family, the true camels of Asia and the llamas of South America, are not represented in North America; but for ages the family was confined to the latter continent and here underwent a great diversification or development. Most branches of the stock have become extinct, leaving only the two just enumerated. The earliest members of the family that so far can be identified are found in the upper Eocene or Uinta stage. There at least four of the tribes of the family may be distinguished; and from then on camels and horses are always the most numerous and diversified mammals of each succeeding stage of the Tertiary period. In the latter part of the Tertiary, the Quaternary or Pleistocene, gigantic members of the family are common, ending in *Camelops*, so abundantly found in the tar pits of southern California, an animal which survived into Recent time, probably in times which in Europe are called "historic." It

was in the Pliocene that the ancestors of modern true camels migrated to Asia, and the modern llamas and their allies to South America. In addition to this main line there were several branches; one the giraffe-like camels in which evidently, from the very long neck and long forelegs, the browsing habit of giraffes may be inferred. This line was characteristic of the Miocene and early Pliocene, and then died out. Then there were the gazelle-like camels, also Miocene and Pliocene, which have left no descendants, but which are remarkable for their slenderness of limb. These are animals of small size, not exceeding sheep in height. So far the single family Camelidae has been considered. There were other allied families which belonged to the same suborder Tylopoda, also exclusively American, but much more deer-like than the true camel. Some of these are extremely minute animals no larger than jack rabbits, and some even no larger than cotton-tails. Then a subdivision of this family developed grotesque outgrowths of the skull which were more or less horn-like in shape but probably not carrying horns. These reached their culmination in size and peculiar appearance in the lower Pliocene. Other families still further removed from the main line are of somewhat doubtful position; but the curious fact remains that for all of them North America was their only home until the Pliocene, when the migrations to Asia and South America already mentioned took place.

Palmer's instrumental observations in connection with the discovery of Antarctica: LAWRENCE MARTIN (introduced by W. C. Mendenhall). Magnetic declination and oceanography contribute to the evidence that Captain Nathaniel Brown Palmer, of Stonington, Conn., discovered the Antarctic continent in 1820. Two generalizations may be based upon a study of the log of the *Hero*, Palmer's sloop, now preserved in the Division of Maps at the Library of Congress. (1) Although no determination of longitude was recorded by Palmer at the point where he made his Antarctic landfall, his latitude is so dependable that the historic spot may be identified with precision. This is a coast trending northeasterly and southwesterly. *Given a reliable determination of latitude and a good map of a meridional or diagonal coast, no longitude is necessary for the identification of a precise position.* (2) At 63° 45' south latitude Palmer recorded in his logbook that he "discovered a strait trending S S W and N N E." The northeastern end of Orleans Channel is situated at 60° 10' west longitude and 63° 45' south latitude. The axis of the strait, according to modern charts, is not north northeast and south southwest; but the trend recorded in 1820 was, of course, magnetic rather than true. Upon the application of a correction of some 25° of magnetic declination for the compass direction of the year 1820, however, Palmer's determination of the axis of Orleans Channel is found to be essentially correct. Dumont d'Urville saw only the northeast end of Orleans Channel in 1838; the French Service Hydrographique did not bring out until 1912 the chart of the South Shetland Islands showing the results of Charcot's explorations in 1904-5 and 1908-9. *Accordingly, as no one published a complete map of the Orleans Channel for 92 years after Palmer's*

visit, the Stonington sealer's reliable record of the axial trend of this strait in 1820 is a singularly attractive proof that he was there.

The western interior region of North America in later Cretaceous time: JOHN B. REESIDE, JR. (introduced by W. C. Mendenhall). During earlier Cretaceous time the western interior region of North America was mostly a land area of low relief. Early in later Cretaceous time marine waters spread over a long strip extending from the Arctic to the Gulf of Mexico and persisted until nearly the end of the epoch. The sediments brought into this sea came in greater part from the west and constituted three general belts—a western belt of dominantly coarser material in great thickness; a middle belt of interfingering coarser and finer material, also of considerable thickness; and an eastern belt of dominantly finer material in small thickness. The position of the western margin of the marine waters may be inferred with considerable confidence for a number of epochs: that of the eastern margin is for most epochs no longer determinable. Volcanic activity at many times is indicated by beds of altered volcanic ash. Ten wide-spread zones of marine fossils have afforded correlations; an eleventh zone of non-marine fossils is also wide-spread, but a succeeding twelfth zone of marine fossils is much restricted. Dating the deposits by these faunal zones, the following inferences may be drawn: (1) The invading sea spread rapidly and in the time of the first zone (lower Benton) reached apparently its maximum extent. (2) The third zone (lower Carlile) is much less widely known, and its time may have been one of reduced sedimentation. (3) The fourth zone (upper Carlile) is composed of sands and muds, and its epoch was a time of shallower waters. (4) The fifth and sixth zones (Niobrara) represent an epoch of long duration or abundant sedimentation; the deposits are thick and wide-spread, reaching a second maximum. (5) The seventh, eighth and ninth zones (Pierre) show an oscillating but progressive advance from the west of coarser material, non-marine sediments eventually displacing marine. (6) The tenth zone (Fox Hills) continued and completed the withdrawal of marine waters and was succeeded everywhere by the eleventh zone (Lance-Laramie) of fluviatile material. (7) The twelfth zone (Cannonball) is of very restricted area and peculiar fauna; its significance is dubious. The next deposits are definitely of Tertiary age.

Normal micro- and macro-cephaly in aboriginal American crania: ALEŠ HRDLIČKA. The speaker presented a report on the great extent of what must be considered as normal variation in the crania of the American aborigines. Among the approximately 12,000 crania of the American Indian and Eskimo now preserved in the Division of Physical Anthropology, U. S. National Museum, there are over thirty the cranial capacity of which ranges from 1,050 to 910 cc; and there is approximately the same number of skulls the capacity of which ranges from 1,750 to 2,100 cc. All these skulls, both externally and internally, appear normal, and though at its extremes fall well within the curve of varia-

tion in size of the American skull. The largest of the crania here reported show materially more than twice the brain size (skull capacity) of the smallest. There is no indication of a tendency towards any segregation within the range of either the small or the large crania. The small skulls were apparently always accompanied by small stature; the large skulls, so far as known, belonged to individuals of good stature and development, but in no case excessive. The possessors of the smallest skulls could perhaps be called pigmies but not dwarfs; the owners of the large crania were in no instance giants. The here reported variation exceeds in both directions the normal variation in the size of the skull thus far recorded in the White people and other races, though that may be due to less ample records. Its causes are not yet understood, except so far that the smallest specimens are found predominately in groups in which the general average of skull size is sub-medium, while the larger specimens occur individually in groups where the mean cranial capacity tends to be high. The facial features correlate more or less with the size of the vault, and both the facial features as well as the teeth in all these specimens—so far as preserved—are entirely normal. (The specimens here dealt with were shown in a special case among the exhibits of the academy).

Biographical memoir of Albert Abraham Michelson: R. A. MILLIKAN. (Read by title.)

Biographical memoir of Nathaniel Lord Britton: E. D. MERRILL. (Read by title.)

Biographical memoir of William Morton Wheeler: G. H. PARKER. (Read by title.)

Biographical memoir of Othniel Charles Marsh: CHARLES SCHUCHERT. (Read by title.)

Biographical memoir of Marshall Avery Howe: W. A. SETCHELL. (Read by title.)

Biographical memoir of Henry Prentiss Armsby: FRANCIS G. BENEDICT. (Read by title.)

Biographical memoir of Harris Joseph Ryan: W. F. DURAND. (Read by title.)

Biographical memoir of Michael Idvorsky Pupin: BERGEN DAVIS. (Read by title.)

Biographical memoir of Walter Jones: W. MANSFIELD CLARK. (Read by title.)

Biographical memoir of Henry Mitchell: H. A. MARMER. (Read by title.)

Biographical memoir of George Owen Squier: ARTHUR E. KENNELLY. (Read by title.)

Biographical memoir of George Cary Comstock: JOEL STEBBINS. (Read by title.)

Biographical memoir of George Perkins Clinton: CHARLES THOM. (Read by title.)

Biographical memoir of Erwin Frink Smith: L. B. JONES. (Read by title.)

SPECIAL ARTICLES

CONCENTRATION AND PURIFICATION OF CHICKEN TUMOR I AGENT

PREVIOUS work has shown that the chicken tumor agent could be concentrated and partially purified by means of high speed centrifugation.^{1, 2} The fraction separated by this method had a relatively low tumor-producing power and represented no more than 10 to 20 per cent. of the activity of the original material. In the present experiments, the activity of the tumor extracts has been considerably enhanced, and a purified fraction, which exhibits a high tumor-producing power, has been prepared. The method consisted in the serial extraction of frozen tissue from selected tumors and purification of the extracts in a high-speed centrifuge. With minor modifications the procedure used in the fractionation was that adopted in a previous work.² During the experiment, the temperature of the active material was always maintained near 0° C., except for the first run at high speed when the temperature attained 12 to 14° C. Extractions and washings were made with a 0.005M phosphate buffer solution of pH 7.0. Because of the rapid deterioration of the agent *in vitro*, especially in the purified form, preparation of the tumor fraction and activity tests were performed in one day, the experiment being completed in about fourteen hours.

Under these conditions, the purified fraction was found to correspond, in terms of dry weight, to 3.5 per cent. of the original extract and 1.8 per cent. of the total tumor or about 2.2 mg dried substance per gram of fresh tumor tissue. The purified fraction, first brought back to the volume of the original extract, was fully active at 10⁻⁷ dilution, and exhibited a tumor-producing activity 10 to 50 times greater than that of the original extract, kept as control at 1° C. during the experiment. 5.2 × 10⁻¹² gram of this purified substance produced vigorous tumors in the skin of adult Plymouth Rock hens, 13 to 17 days after inoculation. This quantity represents about 20,000 units if we assume for the tumor agent a particle weight of 2.34 × 10⁻¹⁶ gram, a value calculated for a radius of 3.5 × 10⁻⁶ cm and a density of 1.3.³ The results indicate that figures at least ten times smaller could have been obtained had even greater dilutions been tested for tumor-producing activity.

The purified fraction is soluble in neutral water or

neutral buffers of low salt content, in practically all proportions, until a gel is formed when the substance is concentrated in the centrifuge. The active fraction gives colloidal solutions between pH 7 and 11.5. On the acid side, the solubility curve indicates that the substance is very sensitive to a change in hydrogen-ion concentration. At pH 6.8, aggregation is already noticeable, as shown by a definite increase in the opalescence of the solution. The point of minimum solubility and also, probably, the isoelectric point is near pH 3.5. Solutions containing 0.15 mg substance per cc are completely precipitated between pH 2.6 and 4.6.

The purified fraction is insoluble in absolute alcohol, acetone, ether, chloroform and benzene. A 0.015 per cent. solution of the substance in phosphate buffer is precipitated at pH 7. with 0.4 saturated ammonium sulfate. The substance is not precipitated from solution by 80 per cent. alcohol and less opalescent solutions are produced by dilute alcohol. This is probably due to the presence of a lecithin as a component of the active material. After drying, the purified substance is no longer soluble in water, salt solutions or 80 per cent. alcohol. The fraction is not coagulated by heat, but heating at 54° C. for twenty minutes, a treatment which inactivates the agent, or at 95° C. for thirty minutes, seems to produce a slight decrease in the opalescence of the solution. Upon freezing at -80° C. for 24 hours, about 90 per cent. of both solubility and activity are lost whereas on standing at -2° C. the purified fraction remains in solution although losing 80 to 90 per cent. of its tumor-producing power in the course of three days.

The results of chemical analysis indicate that about 9.0 per cent. of the active material is nitrogen, a value obtained from seven different tests with 8.6 and 9.5 per cent. as lower and upper limits. About 24 per cent. of the purified fraction is soluble in ether. The major part of this lipid fraction has the properties of a phospholipid, probably a lecithin, with 3.1 per cent. phosphorus. About one third of the lipid fraction is insoluble in most organic solvents but is soluble in chloroform and pyridine. This portion has not been definitely identified. It is yet undetermined whether these different lipid components are related to the tumor-producing property of the purified fraction or are carried along incidentally with the active principle. Since the density of lecithin is greater than that of water it could be expected to become associated with the fraction separated by this centrifugation method. However, it is interesting to note that a similar

¹ J. C. G. Ledingham and W. E. Gye, *Lancet*, 1: 376, 1935; J. McIntosh, *Jour. Path. and Bact.*, 41: 215, 1935.

² A. Claude, *Am. Jour. Cancer*, 30: 742, 1937.

³ W. J. Elford and C. H. Andrewes, *Brit. Jour. Exp. Path.*, 17: 422, 1936; A. Claude, *Jour. Exp. Med.*, 66: 59, 1937.

amount, 26 per cent., of phospholipids had been found to be associated with an active tumor fraction purified by entirely different methods.⁴ The portion of the purified fraction which is not soluble in ether contains 13.11 per cent. nitrogen and about 0.5 per cent. phosphorus.

Chemical tests for thymonucleic acid were negative, whereas the complete fraction or the ether extracted material gave strongly positive tests for pentoses. The biuret and Millon's tests were positive.

The ultra-violet absorption curve of the purified fraction presents a broad maximum at $\lambda 2575$,⁵ a region of absorption which is also typical of nucleic acid.⁶ This observation, together with the results of the chemical tests and the presence of at least 0.5 per cent. phosphorus, suggests that an important constituent of the active tumor fraction may be a nucleic acid of the ribose type.

The fact that the purified material was found to possess a tumor-producing activity far greater than that of the original extract suggests that centrifugation separated the active agent from inhibitory elements, an observation which is in agreement with previous work.⁷ The enhanced activity of the purified fraction as compared to that of the whole extract was especially marked when the tumor tissue had been frozen at -80°C . prior to extraction. Exposure to this temperature is known to disrupt a large proportion of the cells, thus releasing more of the intracellular elements. Under these conditions, the yield in tumor agent was considerably increased, but the relative inhibition of the original extract was also more pronounced. These results may indicate that the inhibitor involved is of intracellular origin.

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AN ESTIMATE OF THE RELATIVE DIMENSIONS AND DIFFUSION CONSTANT OF THE TOBACCO-MOSAIC VIRUS PROTEIN

THE specific viscosity of solutions of the tobacco-mosaic virus protein is proportional to the concentrations of the virus up to concentrations of 1 per cent. Data are presented in Table 1. Assuming a partial specific volume of .646¹ and neglecting hydration, we

⁴ A. Claude, *Jour. Exp. Med.*, 61: 41, 1935.

⁵ A. Claude and A. Rothen, *Am. Jour. Cancer*, 26: 344, 1936; A. Claude, *Am. Jour. Cancer*, 30: 742, 1937. The study of the ultraviolet absorption power was made in collaboration with Dr. A. Rothen.

⁶ T. Caspersson, *Skand. Arch. Physiol.*, 73: supplement No. 8, 1936.

⁷ A. Claude, *Jour. Exp. Med.*, 66: 59, 1937; *SCIENCE*, 85: 294, 1937.

¹ Inga-Britta Erikson-Quensel and The Svedberg, *Jour. Am. Chem. Soc.*, 58: 1863, 1936.

TABLE I
SPECIFIC VISCOSITY OF SOLUTIONS OF THE TOBACCO-MOSAIC VIRUS

Protein in phosphate buffer at pH 6.8 (temp. = 25°C .)	
$n/n_0 - 1$	Concentration of protein in per cent.
.641	1.0
.385	.631
.282	.5
.325	.465
.098	.20
.055	.10
.025	.063
.012	.042

obtained a coefficient of 86.9, which deviates considerably from the theoretical value of 2.5 demanded by the Einstein equation for spherical particles. Deviations of this kind are frequently observed in the study of viscosities of colloids, and they are attributed to the influences of the shape and solvation of the particles, among other things. The Kuhn² Equation (1) relates the relative volume occupied by the particle, the specific

$$(1) \quad n/n_0 - 1 = \phi \left(2.5 + 1/16 \left(\frac{a}{b} \right) \right)$$

$(n/n_0) - 1$ = specific viscosity
 (a/b) = ratio of long to short axis of particle
 ϕ = fraction of total volume occupied by the particle

viscosity and the relative dimensions of rigid elongated particles in solution. If we assume the validity of the Kuhn equation and set our value of 86.9 equal to the

coefficient $(2.5 + 1/16 \left(\frac{a}{b} \right)^2)$, we obtain the value of

36.8 for the ratio of the long to short axis of the virus particle. Assuming a particle weight of 17,000,000, a density of 1.55, and the effective shape of a prolate spheroid for the virus particle, the semi-minor and semi-major axes of the particles assume the values respectively of 3.4×10^{-7} and 1.98×10^{-5} cm.

In the estimate of the diffusion constant from the viscosity data, use was made of the suggestions by Polson³; the essential data being those obtained from viscosity studies, and the particle weight, independently evaluated. We also made use of the Herzog, Illig and Kudar⁴ Equation (2), which evaluates the

$$(2) \quad \frac{D}{D_0} = \frac{1}{2} \left[\frac{\left(\frac{b}{a} \right)^{2/3}}{\sqrt{1 - \left(\frac{b}{a} \right)^2}} \ln \frac{1 + \sqrt{1 - \left(\frac{b}{a} \right)^2}}{1 - \sqrt{1 - \left(\frac{b}{a} \right)^2}} \right]$$

D = diffusion constant of the particle

D_0 = diffusion constant on the assumption of a spherical particle

$\frac{b}{a}$ = ratio of short to long axis of the ellipsoid

effect the relative dimensions of a free diffusing pro-

² W. Kuhn, *Zeits. Phys. Chem. A*, 161: 1, 1932.

³ Alfred Polson, *Nature*, 137: 740, 1936.

⁴ R. O. Herzog, R. Illig and H. Kudar, *Zeits. Phys. Chem.*, A 167: 329, 1933.

late spheroid will have on its diffusion constant. Substituting our value of $1/36.8$ for b/a in Equation 2, and solving for D/D_0 we obtain the ratio of .34. If we assume a spherical particle of weight 17,000,000 and a density of 1.55', we obtain for the ideal diffusion constant, D_0 , the value of 1.33×10^{-7} . The diffusion constant of the virus, then, will have the calculated value of 4.5×10^{-8} .

This value of 4.5×10^{-8} for the diffusion constant of the virus protein is in fair agreement with the value of 3×10^{-8} obtained using a sample of the virus protein in a .1 M phosphate buffer at pH 6.8, which was kindly placed at the disposal of Hans Neurath by Dr. W. M. Stanley.⁵ In view of our neglect of the hydration factor in the calculation of the ratio a/b , the close agreement between the observed and calculated diffusion constants does indicate that the protein is relatively hydrophobic.

Inasmuch as the equations used in our calculations were derived on the assumption of rigid and essentially isolated particles, the values we have obtained are at best approximations. It is doubtful that we may regard the particles as isolated, inasmuch as the length of the particles is of the order of the inter-particle distances. In addition, it is not to be presumed that the particles are rigid. And finally, the assumption of a prolate spheroid for the shape of the virus protein particles was for the sake of convenience in calculation.

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THE MOLECULAR WEIGHT AND SHAPE OF TOBACCO MOSAIC VIRUS PROTEIN

SEDIMENTATION studies have been made by Eriksson-Quensel and Svedberg¹ and by Wyckoff² on the tobacco mosaic virus protein isolated by Stanley.³ In order to calculate the molecular weight from these studies, it is necessary to know the dissymmetry factor of the protein. This is usually obtained from sedimentation equilibrium measurements, but, because of the extremely high molecular weight of this protein, it was not found possible to obtain satisfactory results by this method. Since the tobacco mosaic virus protein is known to have highly asymmetrical rod-shaped par-

ticles in aqueous solution,⁴ it seems probable that the molecular weight of 17×10^6 , ascribed to the material on the assumption that its dissymmetry factor is 1.3, is too low.

It is possible to obtain an idea of the dissymmetry of rod-shaped particles from studies of the viscosity of solutions or suspensions of these particles. Kuhn⁵ has derived the following equation relating viscosity of a suspension or solution of rod-shaped particles to the relative volume and the relative dimensions of the particles of the disperse phase:

$$\frac{\eta}{\eta_0} = 1 + 2.5 G + \frac{G}{16} \left(\frac{b}{a} \right)^2$$

G is the volume of the dispersed material per cc of solution, $\frac{\eta}{\eta_0}$ is the relative viscosity of the solution,

and $\frac{b}{a}$ is the ratio of length to diameter of cylindrical

rods of the disperse phase. The specific volume of the protein was taken to be 0.73 cc/gm.⁶ Viscosities were determined using a high precision quartz viscometer⁷ on very dilute aqueous solutions of tobacco mosaic virus protein isolated by ultracentrifugation repeated 4 and 5 times, without any chemical treatment whatever. The data are given in Table I. The viscosity

TABLE I

RELATIVE VISCOSITIES OF AQUEOUS SOLUTIONS OF TOBACCO MOSAIC VIRUS PROTEIN AT 25° C.

$\frac{\eta}{\eta_0}$	grams protein 100 cc
1.0059	0.0099
1.0165	0.0296
1.0272	0.0458
1.0278	0.0494
1.0542	0.0920
1.0566	0.0988
1.6009	0.920

is a linear function of concentration up to a concentration of 0.1 per cent., but the linearity does not hold for concentrations as great as 1 per cent. The value of $\frac{b}{a}$ calculated from the limiting slope of the viscosity-concentration curve, using Kuhn's equation and assuming little or no hydration, is 35.0.

Perrin⁸ has derived the following expression relating the ratio of minor to major axes of an elongated ellipsoid of revolution to the dissymmetry constant of a particle:

⁴ W. N. Takahashi and T. E. Rawlins, *Proc. Soc. Exp. Biol. and Med.*, 30: 155, 1932; M. A. Lauffer and W. M. Stanley, *Jour. Biol. Chem.*, 123: 507, 1938.

⁵ W. Kuhn, *Kolloid Zeit.*, 62: 269, 1933.

⁶ F. C. Bawden and N. W. Pirie, *Proc. Roy. Soc.*, B 123: 274, 1937; W. M. Stanley, *Jour. Phys. Chem.*, 42: 55, 1938.

⁷ The author wishes to express his gratitude to Drs. D. A. MacInnes and L. G. Longworth for the use of the quartz viscometer and the facilities of their laboratory.

⁸ F. Perrin, *Jour. Phys. et Rad.*, 7: 1, 1936.

⁵ The value of 3×10^{-8} is the result of a preliminary study of the virus protein using the refractory method of Lamm (*Z. Phys. Chem.*, A 138: 313, 1928). Detailed studies on diffusion will be presented in a subsequent publication.

¹ I. B. Eriksson-Quensel and T. Svedberg, *Jour. Am. Chem. Soc.*, 58: 1863, 1936.

² R. W. G. Wyckoff, *Jour. Biol. Chem.*, 121: 219, 1937.

³ W. M. Stanley, *SCIENCE*, 81: 644, 1935; *Ergebn. Physiol.*, 39: 294, 1937.

$$\frac{f_0}{f} = \frac{\rho^{2/3}}{\sqrt{1-\rho^2}} \log_e \frac{1 + \sqrt{1-\rho^2}}{\rho}$$

where $\frac{f_0}{f}$ is the reciprocal of the dissymmetry constant and ρ corresponds to $\frac{a}{b}$ of Kuhn's equation. Substituting the value $1/35$ for ρ , we find a value of 0.396 for $\frac{f_0}{f}$ or 2.52 for $\frac{f}{f_0}$. The molecular weight can be calculated by use of the equation⁹

$$\frac{f}{f_0} = \frac{M \frac{(1-Vd)}{S_{20}}}{6\pi\eta N \left(\frac{3MV}{4\pi N} \right)^{1/3}}$$

M is the molecular weight of the protein, V is the specific volume of the protein in solution, d is the density, S_{20} is the sedimentation constant at 20° C. taken to be 174×10^{-13} ,¹⁰ η is the viscosity coefficient, and N is Avogadro's constant. A value of about 42.5×10^6 , more than 2 times that suggested originally, is found for the molecular weight of the protein by this method. This would correspond to a particle 12.3 μ in diameter and 430 μ in length. This value of the molecular weight is reliable only to the extent to which the equation of Kuhn is applicable to the system under investigation and to which the assumption of no hydration is valid. This treatment of the subject emphasizes the necessity of knowledge of the shape and state of hydration of the tobacco mosaic virus protein in order to enable one to interpret accurately the data from the ultracentrifuge.

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THE PRESENCE OF RARE EARTHS IN HICKORY LEAVES

It has been established in the Bureau of Chemistry and Soils that the leaves of the hickory and sweetleaf may contain as much as 1.5 and 6.5 per cent. of crude Al_2O_3 , respectively, in the air-dry leaf. The quantities present in the hickory vary from a few hundredths of 1 per cent. in neutral soils to the above quantities found in acid soils.

The abnormal behavior of the crude alumina precipitate obtained from the hickory leaves from a tree growing in a pegmatite vein of the Moorefield mine, Amelia, Va., led to the separation of a concentrate of the rare earth group of oxides amounting to 0.2 per cent. of the dry weight of the leaves. This figure is probably low, as there may have been some losses in the separations. The colors of the solutions, oxides and oxalates and behavior of the hydroxides indicated

a mixture of cerium, lanthanum, praseodymium and neodymium.

A spectroscopic examination was made at the National Bureau of Standards for the individual rare earths, which are extremely difficult to separate when present in small quantities. The presence and relative abundance of the rare earth elements are shown in the following table:

TABLE 1
SPECTROSCOPIC EXAMINATION OF RARE EARTHS FROM
HICKORY LEAVES*

Element	Oxides from oxalate, several precipitations	Oxides from fluorides, through hydroxides
Cerium	Very strong	Strong
Lanthanum	Strong	Weak
Praseodymium	Strong	Strong
Neodymium	Strong	Strong
Yttrium	Strong	Strong
Samarium	Moderate	Moderate
Europium	Moderate	Moderate
Gadolinium	Very weak	Weak
Dysprosium	Very weak	Weak
Erbium	Trace	Very weak
Ytterbium	Trace	Very weak

* The strengths of the lines of the respective elements were compared using the following scale: Very strong, Strong, Moderate, Weak, Very weak, and Trace.

Scandium, terbium, holmium, thulium and lutecium were not found. Due to lack of information concerning the spectrum of illinium (61), a test was not made for this element.

The presence of "moderate" lines of europium, one of the rarest of the rare earths, is interesting and may point to a concentration of this element by the hickory leaves.

The rare earths are widely distributed and occur in the earth's crust in quantities smaller, but comparable to the quantities of phosphorus and manganese. They have been found in many soils in concentrations up to .05 per cent. The rare earths, lanthanum in particular, are comparatively strong bases. The fact that the rare earths resemble calcium, in forming insoluble oxalates and fluorides, is an indication that the rare earths may substitute for calcium in the growing plant, where that element is deficient. In some of their properties, however, the rare earths more nearly resemble aluminium, and in this case are absorbed by an aluminum-loving plant.

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BOOKS RECEIVED

LEWIS, BERNARD and GUENTHER VON ELBE. *Combustion, Flames and Explosions of Gases*. Pp. xiii + 415. 79 figures. Cambridge University Press; Macmillan. \$5.50.

SHULL, A. FRANKLIN. *Heredity*. Third edition. Pp. xvii + 442. 168 figures. McGraw-Hill. \$3.50.

⁹ T. Svedberg, *Chem. Rev.*, 14: 1, 1934.

¹⁰ R. W. G. Wyckoff, *loc. cit.*